

REPORT OF THE JORHAT AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING 31st MARCH 1921.

1. *Introduction* —This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of most rabi crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factor causing this sterile condition with a view to its amelioration. This work has been going on since 1908, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather, and also to certain crops in the rains, is due to the accumulation of acid substances, amongst them being a specific toxin which has been isolated and experimented with in culture solutions, with effects on the plant's root system and growth precisely similar to those observed in the field; these are readily neutralised and rendered harmless by dressings of lime or other base to the soil. An account of the experimental results leading up to this conclusion has been published as a memoir of the Department of Agriculture in India, Chemical Series, Volume III, No. 9, entitled "Studies of an acid soil in Assam."

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates. Phosphoric acid has an effect second only to that of lime on these soils, but is preferably used in a basic form such as basic slag, for instance, rather than in the form of acid superphosphate. While small initial applications of the latter act beneficially, its application in very large doses or its continued use over a number of years in our own experience is nearly detrimental in the absence of periodic lime dressings on our soils. If used in conjunction with lime, however, the case is quite a different one.

The original area of the station was about $35\frac{1}{2}$ acres, of which 7 acres is *hola* or ravine land and the remainder high land, which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land.

The total area at present is thus $59\frac{1}{2}$ acres. Most of the newly-added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. *Soil*.—The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth:—

Report on analyses of Jorhat Farm soil by the Agricultural Chemist, Assam.

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No. 5(a).
1	2	3
A		
<i>Soluble in Hydrochloric acid with 12 hours' digestion at 100°C.</i>	Per cent.	Per cent.
Phosphoric acid ($P_2 O_5$)... ..	0.025	0.020
Potash ($K_2 O$)	0.115	0.185
Lime ($Ca O$)	0.154	0.144
Magnesia ($Mgo.$)	0.166	0.143
B		
<i>Soluble in one per cent. citric acid with 7 days' digestion.</i>		
Phosphoric acid	0.008	0.008
Potash	0.007	0.011
C		
Loss on ignition (organic matter and combined water)	3.26	1.54
Nitrogen	0.115	0.051
Calcium carbonate	0.018	0.018
Reaction	Acid	Acid

These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

A good deal of the organic matter present is of doubtful character and consists very probably of very old residues of little value; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quality of carbonate of lime, conditions for nitrification and soil bio-chemical processes generally are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in "total" as well as "available" supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do, offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself, very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element and to respond to its suitable application :

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous

to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crops will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that the green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures, no amount or combination of the latter can ever make up, in the case of a crop like sugarcane, for loss of fertility due to shallow cultivation and lack of "humus."

3. *Buildings machinery, etc.*—The farm is provided with a godown, combined office and rest-house, manager's bungalow, clerk's and apprentices' quarters, cattle shed, Dutch barn, manure shed, etc., and is enclosed by "Ideal" wire fencing.

A Hornsby oil engine and crushing-mill capable of dealing with 1 ton of cane per hour was installed in 1911.

During the year the following "Petty Construction" was carried out on the Farm :—

				- Rs. a. p.		
1. Temporary quarters for Assistant Farm Manager ...	350	0	0			
2. Seven coolie huts with iron rail posts ...	...	491	15	1		
3. Megass shed ...	...	...	28	4	0	
4. Cook sheds for apprentices ...	...	...	74	0	0	
5. Gur boiling shed ...	...	...	153	0	0	
Total ...	...	1,097	3	1		

In addition a tank for the supply of water to the farm coolies was excavated at a cost of Rs. 200.

4. *Rainfall*.—The rainfall recorded during the year under report is given below together with the normal rainfall for each month :

	Month.	Actual, inches.	Normal, inches.
1	2	3	4
1920	April ...	9.89	8.54
	May ...	8.88	9.26
	June ...	8.60	11.36
	July ...	17.96	14.76
	August...	16.67	15.15
	September	7.56	9.18
	October	2.36	4.07
	November	0.45	0.69
1921	December	0.05	0.52
	January	1.33	0.93
	February	1.51	1.32
	March	5.62	3.09
Total ...		80.88	79.68

The season was on the whole a normal one and calls for no particular comment, except perhaps in the case of September and October when the rainfall was somewhat deficient, and in March when the weather, while favourable for the planting of the new cane crop, interfered to some extent with the harvesting and threshing of the *rabi* crops.

5. *Experimental work* :—This includes the following :

- I. Sugarcane Experiments—Varietal, manurial and introduction of new varieties.

II. *Soil investigations and manurial experiments.*

III. Trials of new crops or new varieties—Pulses, green crops, etc.

IV. *Trials of fodder crops.*

6. *Sugarcane*.—This work includes the testing and selection of varieties, exotic and local, under chemical control; manurial and other experiments in the cane rotation and the distribution of suitable varieties to cultivators. The varieties distributed were Striped Mauritius, B376, B147 and J33a. The young crop planted early in March germinated and got away well, and made fine subsequent growth.

The ratoon crop was not analysed this year on account of the absence of the Agricultural Chemist on leave. Analytical figures for the plant cane are however given, and show that the crop had ripened off well, the dry cold season and comparatively early close of the rains accounting for this.

7. *Sugarcane varieties—Ratoon cane Block "B"*.—The following ten varieties planted in Block "B" in 1919 were ratooned:—B147, Striped Mauritius, B376, Barbadoes A, B6450, B3412, J33a, Barbadoes B, Magh Sport and the local variety Magh. The results of the previous plant cane crop appeared in paragraph 8 of the last year's report.

Inter-cultivation was carried out by a single bullock, spring-tyned cultivator, which does excellent work in cane rows 4 feet or more apart.

Manuring consisted of 2,000 lb. oilcake per acre (100 lb. Nitrogen) applied half at first earthing and half at second earthing. The plots were harvested in January—February 1921. Here and there a good deal of damage to the crop was evident from Borer, white ants or rats, or combinations of these evils. In this respect those varieties which lodged easily, either by habit or excessive growth, naturally suffered most.

The crop results appear in Tables I and II. The cane yields were in some cases excellent for a ratoon crop, and on the whole good, the average yield for the ten varieties being over 23 tons stripped cane per acre.

Striped Mauritius, Barbadoes A, B3412 and J33a returned very heavy crops, the average for these four varieties being 34 tons per acre, J33a leading with an average crop of 35 4 tons per acre.

The heaviest outturn of *gur* per acre was however returned by Striped Mauritius with 3.04 tons per acre. Close on 3 tons *gur* per acre was also given by Barbadoes A, B3412 and J33a.

For two consecutive years J33a has thus yielded the heaviest crop of ratoon cane and should be a valuable asset to the cultivator on this account.

The local variety *Magh* did extremely poorly this year as a ratoon crop—much worse than usual.

As was remarked in the case of the plant cane crop on this block last year, so with the ratoon this year in a few cases the difference in yield between duplicate plots of the same variety was unusually great. In the case of most varieties however the duplicates agreed fairly well.

Phosphated area.—For the whole area under cane the average yield of cane from the phosphated plots exceeded that from the non-phosphated area by just over 1 ton stripped cane per acre. In the preceding plant cane crop of the previous year the average increase in favour of the phosphated area was two tons per acre. For the two crops therefore the net increase in favour of the phosphated area is some 3 tons stripped cane per acre, which is again well within the limits of experimental error, and to which no positive value can therefore be attached.

TABLE I.

BLOCK B. RAFTON CANE, 1920-21. *Varieties. (Non-phosphated area).*

Variety.	Plot No.	Plot area.	Cane (lbs. per acre.)	Yield (lbs. per acre.)	Expressed.	Gur (lbs. per acre.)	Percentage per on cane.	Remarks.
1	2	3	4	5	6	7	8	9
B 147 ...	1	Acres.	Lbs.	Lbs.	Per cent.	Lbs.		
...	11	$\frac{1}{16}$	37,900	23,400	61.7	3,680	9.61	
B 376 ...	2	"	58,180	34,920	60.0	5,030	8.64	
...	12	"	55,240	33,780	61.1	4,720	8.54	Crop damaged by rains
Striped Mauritius ...	3	"	53,920	34,040	63.1	4,480	8.31	
...	13	"	71,200	42,680	9.9	6,200	8.70	
Barbadoes B ...	4	"	78,120	48,220	61.7	7,280	9.32	
...	14	"	49,740	32,120	64.6	3,820	7.69	
Barbadoes A ...	5	"	43,260	6,420	61.0	3,540	8.18	
...	15	"	73,740	46,680	63.3	7,800	10.57	
B 6150 ...	6	"	82,440	50,160	60.8	6,680	8.10	
...	16	"	21,360	13,340	62.6	2,100	9.83	
		"	31,820	20,000	63.4	3,380	10.40	

B 3412	...	...	...	...	75,320	48,200	64.0	6,280	8.34
	...	...	...	...	80,680	51,020	63.3	7,280	9.03
J 33a	...	...	...	...	73,640	40,980	55.6	5,840	7.93
	...	...	...	...	68,980	40,000	57.9	5,680	8.23
Magh Sport	...	...	...	...	35,480	18,940	53.4	Not record- ed.	...
	...	...	...	...	22,960	12,520	54.5	1,800	7.34
Magh	...	...	...	...	9,640	5,780	59.9	Not record- ed.	...
	...	...	...	...	6,560	3,880	59.1	460	7.01

TABLE II.
Block B. Ratoon Cane 1920-21. Varieties. (Phosphated area).

Variety.	Plot No.	Plot area.	Cane (lbs. per acre.)	Juice (lla. per acre.)	Expression.	Gst (lbs. per acre.)	Percentage gur on cane.	Remarks.
1	2	3	4	5	6	7	8	9
B 147 ...	{ 1 ... 11 ...	{ 1 1/10 ... " " ...	{ 80,420 37,940	{ 49,120 24,240	{ Per cent. 610 639	{ Lbs. 8,040 3,920	{ 9.99 10.3	{ Crop damaged by rats.
B 376 ...	{ 2 ... 12 ...	{ " " ... " " ...	{ 52,020 52,320	{ 31,800 32,700	{ 61.1 62.6	{ 4,440 4,440	{ 8.53 8.49	
Striped Mauritius ...	{ 3 ... 13 ...	{ " " ... " " ...	{ 75,700 76,540	{ 45,400 47,840	{ 59.9 62.5	{ 6,600 7,160	{ 8.72 9.35	
Barbadoes B ...	{ 4 ... 14 ...	{ " " ... " " ...	{ 58,360 49,820	{ 34,560 30,320	{ 59.2 60.8	{ 4,460 4,120	{ 7.64 8.27	
Barbadoes A ...	{ 5 ... 15 ...	{ " " ... " " ...	{ 68,880 67,900	{ 42,560 42,740	{ 61.8 62.9	{ 5,680 5,940	{ 8.24 8.74	
B 6450 ...	{ 6 ... 16 ...	{ " " ... " " ...	{ 33,700 34,200	{ 21,220 21,060	{ 62.9 63.3	{ 3,220 3,420	{ 9.55 10.0	

8. *Sugarcane varieties—Plant cane—Block A.*—This block was last under cane in 1916-17; it was green manured with *Dhaincha* and also carried a crop of oats in 1918, followed by cowpeas and rape in 1919. The land lay fallow throughout most of the cold season preceding the planting of the new cane crop in March 1920. Before sowing the cowpeas in 1919 the whole block was dressed with ground limestone 1,600 lbs. per acre, while one acre also got 560 lbs. Flour Phosphate.

The following twenty varieties were planted on both phosphated and non-phosphated areas:—

B147, Striped Mauritius, B376, J33a, Magh, B3412, B6150, Red Mauritius, White Mauritius, D74, Co1, Co9, A2a, Mauritius 55, 131 and 90, J36, J213, J139, J247.

Many of these varieties are new to us and appear in the experimental plots for the first time.

The Red and White Mauritius canes are bud sports of the Striped variety separated on the farm a few years back. The other new Mauritius varieties, as also the Java canes, and of course the Coimbatore seedling canes Co 1 and Co 9 were received a few years ago from Dr. Barber, the late Imperial Sugarcane Expert.

All varieties germinated well and most made good crops. All plots were given the same cultivation and manuring, which consisted of 20,000 lbs. cowdung (100 lbs. Nitrogen) in the trenches at planting, followed by 500 lbs. oilcake at each of the two earthings, making a total of 150 lbs. Nitrogen per acre.

The cane was harvested March to April 1921, many varieties yielding heavy crops, though on the whole not quite so good as last year. The results appear in Tables III and IV.

The average yield for 19 varieties was 30.0 tons per acre on the phosphated as against 31.9 tons on the non-phosphated area. The older varieties kept up their reputation, Striped Mauritius yielding an average crop of 38.4 tons stripped cane per acre followed by B376 with 32.8 tons and B147 with 29.1 tons, B3412 headed the list with 42.4 tons cane per acre, J33a following closely with 38 tons, while Magh the local variety gave 25.5 tons.

Of the new varieties under trial undoubtedly the most promising of the year are Co 9 and D74. The former gave a heavy crop of 37 tons stripped cane per acre of very high quality indeed. It needs watching for a year or two on account of disease however. D74 is fine cropper (it yielded over 39 tons per acre) and of excellent habit; in quality however it suffers somewhat by comparison with Co 9.

The new Java varieties J36, J139, J213 and J247 all gave a fairly good account of themselves; with the exception of J247 they are all rather on the thin side; they are however hard and erect, tiller freely and may prove useful.

Of the recently acquired Mauritius varieties Mauritius 55 and 131 are the most promising, Mauritius 90 being poor looking weedy canes of bad habit.

As regards the Coimbatore seedling canes Co 9, as remarked above, made a fine crop of excellent quality and is most promising; Co 1 gives little hope at present, while unfortunately Co 6, a very soft cane, became literally infested with disease and has had to be entirely destroyed.

The highest yield of sucrose per acre in expressed juice was given by Co 9 with an average of 10,024 lbs. sucrose per acre, followed by B3412 with 8684 lbs. Striped Mauritius with 8455, D74 with 8400, B6450 with 7983, B147 with 7693, J33a with 7568, J247 with 7440, B376 with 7185, J213 with 6758, J139 with 5842, J36 with 5737 and lastly by *Magh* the local cane with only 3733 lbs.

In regard to quality of juice Co 9, B6450, A2a and B147 take pride of place. Other varieties D74, B3412 and J33a, though very heavy croppers, do not approach the above in the quality and purity of their juice.

Phosphated area.—The average increase in crop for all varieties on the phosphated area amounted to 1.1 tons stripped cane per acre. This is an increase too small to which to attach any value at all.

TABLE NO. III.
Block A.—Plant Cane, 1920-21. Varieties (Non-phosphated area). (Figures are per acre).

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Extraction.	Sucrose in juice.	Invert sugar in juice.	Glucose ratio.	Purity Co-efficient of juice.	Sucrose in expressed juice.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12
		Acre.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Lbs.	
B 147 ...	1	1/20	58,680	41,900	71.4	17.44	0.54	3.11	91.0	7,307	
Striped Mauritius ...	2	"	54,220	51,780	61.4	16.20	0.75	4.65	90.6	8,388	
B 376 ...	3	"	69,320	43,900	63.3	15.75	0.55	4.13	90.8	6,914	
J 33a ...	4	"	82,580	46,660	56.5	15.08	1.07	7.1	85.8	7,036	
Magh ...	5	"	57,880	35,240	60.9	11.31	1.30	11.52	81.0	3,986	
B 3412 ...	6	"	92,740	57,000	61.4	14.85	1.09	7.38	88.1	8,465	
B 6450 ...	7	"	65,920	41,740	63.3	18.87	0.25	1.35	99.9	7,876	
Red Mauritius ...	8	"	85,580	52,580	61.4	16.21	0.65	4.01	91.7	8,523	
White Mauritius ...	9	"	89,760	55,460	62.9	15.57	0.84	5.41	90.3	8,790	
D 74 ...	10	"	86,180	53,460	62.0	15.72	0.83	5.26	88.6	8,404	
Co 9 ...	11	"	79,480	51,020	65.3	18.25	0.28	1.31	94.2	9,475	
A 2a ...	12	"	69,000	42,080	61.8	18.58	0.42	2.54	94.0	7,930	

								(All materials used for planting purposes).							
								60,240	36,640	60.8	15.46	0.56			
Mauritius 55	...	...	13	...	"	...	...	60,400	40,920	61.6	16.26	0.41	361	90.3	5,665
J 36	...	...	14	...	"	...	...	60,400	40,920	61.6	16.26	0.41	251	92.3	6,654
J 213	...	...	15	...	"	...	...	61,080	36,720	60.1	16.10	0.40	249	91.5	5,912
J 139	...	...	16	...	"	...	...	50,990	32,134	63.0	16.46	0.45	271	92.1	5,290
Co 1	...	...	17	...	"	...	...	71,040	44,213	62.2	15.48	0.55	353	88.9	6,844
J 247	...	...	18	...	"	...	...	64,780	42,240	65.1	14.77	0.97	658	88.3	6,236
Mauritius 131	...	...	19	...	"	...	...	64,427	40,507	62.8	13.82	0.68	492	87.4	5,598
Mauritius 90	...	...	20	...	"	...	...						

TABLE IV.
Block A, Plant Cane, 1920-21. Varieties (Phosphated area). (Figures are per acre).

Variety.	Plot No.	Plot area.	Cane lbs. per acre.	Juice lbs. per acre.	Extraction.	Sucrose in juice.	Invert sugar in juice.	Glucose Ratio.	Purity Co-efficient of juice.	Sucrose in expressed juice.	Remarks.	
	1	2	3	4	5	6	7	8	9	10	11	12
			Acres.	Lbs.	Lbs.	Per cent.	Per cent.	Per cent.	Per cent.	Lbs.		
B 147	...	1	1.5	74,560	47,360	63.5	17.06	0.51	2.97	90.2	8,080	
Striped Mauritius	...	2	"	87,760	54,100	61.6	15.75	0.75	4.79	90.0	8,621	
B 376	...	3	"	77,440	48,420	62.5	15.40	0.74	4.84	89.8	7,456	
J 33a	...	4	"	87,680	54,880	62.5	14.76	1.22	8.29	84.8	8,100	
Magh	...	5	"	56,540	34,000	60.1	10.53	1.80	17.08	76.5	5,580	
B 3412	...	6	"	37,200	58,720	60.4	15.16	1.17	7.71	87.4	8,902	
B 6450	...	7	"	62,300	43,560	62.9	18.57	0.29	1.56	63.3	8,090	
Red Mauritius	...	8	"	82,100	49,300	60.0	16.60	0.68	4.12	91.5	8,184	
White Mauritius	...	9	"	74,340	45,140	60.7	14.90	1.12	7.51	87.1	6,726	
D 74	...	10	"	91,340	53,900	60.0	15.58	0.88	5.68	88.3	8,398	
Co 9	...	11	"	86,880	57,900	66.6	18.25	0.33	1.80	93.7	10,573	
A 2a	...	12	"	8,720	38,300	...	...	...	...	...	...

9. *New varieties of cane.*—Nine new varieties under trial were nurseried during the year. They consist of five new Java canes received in 1919, and other four, *viz.*, J100, Badila H109 and D95 received from Coimbatore in 1920.

Most of them behaved normally and are being propagated on an extended scale for future trial in the plots. One variety D95 produced a few miserable short canes which flowered and became diseased and had to be destroyed.

10. *Soil investigations and manurial tests.*—The various experiments described in previous reports were continued.

The work includes :—

Block G—Liming Experiment commenced in 1909.

„ C—Liming and manurial experiment ; also an experiment in the use of wood ashes as a soil ameliorant, both commenced in 1911.

„ K—Experiments to elucidate the function of lime on our sour old red alluvial soil and to test the action of various manures and mixtures thereof, with and without lime, commenced 1912.

„ L—Ground Limestone experiment commenced 1912 to test the effect of incorporating lime with the soil to varying depths.

Blocks E, B, A, and D—Experiments in the use of mineral phosphate in the sugarcane rotation. For previous details the earlier reports may be consulted.

11. *Block G. Lime experiment.*—This block contains the oldest lime experiment on the Farm. Half the area was limed at the rate of 50 mds. slaked lime per acre some 12 years ago, and both sections have been regularly and similarly cropped ever since with the object of determining the effective duration of single lime application.

The cropping this year was cowpea green-manure followed by oats. Cowpeas did better on the limed section as usual.

Oats germinated well all over, but died off as seedlings on the un-limed section as in previous years. The lime section matured a small crop. The lime effect is thus still clearly marked 12 years after its application, though it is apparent each succeeding cold weather that sour soil conditions are steadily re-establishing themselves.

12. *Block C. Lime and manurial experiment.*—This experiment, commenced in 1911, had for its chief object to discover whether lime is best applied in large occasional doses or in more frequent smaller dressings. During the first six years of the experiment each of the limed sections received a total of 2 tons of slaked lime per acre, either (a) as one initial application of 2 tons or (b) as two equal triennial dressings of 1 ton each, or (c) in six equal annual doses of $\frac{1}{3}$ rd ton each. Since 1917 the experiment has been continued without further use of lime, for residual effect. Briefly it may be said that during the first few years of the experiment the larger and less frequent lime applications returned the biggest crops. By about the 5th year the smaller more frequent dressings were returning larger yields.

The plots on this block having become very dirty with weeds, it was decided to fallow them throughout the rains in order that by systematic cultivation the weeds might be got rid of.

Para Pea, a small variety of cowpea, was taken as the rabi crop. On account of bad weather this crop had to be resown twice before anything like a regular stand could be obtained, and this was subsequently so badly attacked by soil crickets in October that the whole of the plots became extraordinarily patchy, and quite valueless for any experimental record.

Thus in the 10th year of this experiment, there are no results at all for record.

13. *Wood ashes Experiment.*—Five plots have for several years past been receiving respectively 5, 10, nil, 15 and 20 maunds wood ashes per acre per annum. Half of each plot is cross-dressed annually with 100 maunds cowdung per acre.

Results up to date go to show that wood ashes, more especially the heavier dressings, have a very marked ameliorative effect on this sour soil, and emphasize the importance of cultivators conserving and using ashes along with cowdung.

These plots were also sown with Para Pea in the autumn and suffered the same disastrous fate as the plots in Block C described in paragraph 12 above, owing to heavy falls of rain after sowing and subsequent annihilation by crickets. No figures are therefore available for record.

14. *Block L.—Ground limestone experiments.*—Commenced in 1913 on very infertile newly broken up land, this experiment was continued in its 8th year. The scheme consists of 6 plots, each 1-3rd acre, in two series of 3 plots each. The first series, Section A, is cultivated shallow (3 to 4 inches) with country implements, while Section B, is worked deeper (7 to 8 inches)

with English implements. This ensures a deeper application of the limestone on Section B, the chief objects being to elucidate the effects of incorporating lime with the soil to different depths and to test the value of deep versus shallow—cultivation.

The first application of ground limestone was made in 1913 and repeated in 1919 as follows :—

Sections A and B { Plot—15 maunds limestone per acre.
 „ 2—Nil.
 „ 3—30 maunds limestone per acre.

For further details and previous cropping results, past reports may be consulted.

The cropping this year was as follows :—

Rains—Jowar.

Rabi—Oats.

Jowar was sown early in June and harvested green for fodder in September. Manure applied was 10 maunds oilcake per acre. Some damage was caused by crickets to this crop also, more especially on Section A, which suffered more than Section B, somewhat vitiating the results.

Oats was taken as a cold weather crop, all plots getting a dressing of cowdung 100 maunds per acre, previous to sowing. Germination was normal all over, but most of the seedlings died out at an early stage on the unlimed plots. For the first time in the history of this experiment however a few scattered plants here and there survived and matured on these unlimed areas, which goes to show that under continued cultivation and drainage the type of soil we have on the Farm does slowly improve. It is so slow however as to provide no excuse for withholding lime.

The crops harvested (lbs. per acre) were as follows :—

1	2		3		4	
	Plot 1.		Plot 2.		Plot 3.	
	Green Jowar.	Oats.	Green Jowar.	Oats.	Green Jowar.	Oats.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Section A ...	11,404	555	0	0	14,263	750
„ B ...	11,767	798	0	0	23,632	831

These results are interesting. Up to date the evidence of these plots, as tested by several different crops through 7 years work, has been almost entirely in favour of the more shallow application of the limestone on Section A. This year both crops did best throughout on Section B where the lime is incorporated to a depth of 8 inches. This result follows so closely on the second application of limestone (given in 1919), that it suggests a connection. However for the past few years, and for a year or two previous to the second liming, it was observable that Section B was slowly overhauling Section A, and one is driven to the conclusion that, with lapse of time, deeper cultivation is telling more strongly year by year. This was very strongly marked on the green-manure crop in 1919, when, on the unlimed plots of either section, the green-crop was markedly superior on the deeper cultivated Section B.

15. *Block K.—Experiment on the functions of lime.*—This experiment, continued for the past nine years, was originally laid down to study the functions of lime on our sour soil, and the effect of various artificial fertilisers and mixtures thereof, applied in conjunction with lime and also without it.

The earlier results were described in a Memoir entitled "Studies of an acid soil in Assam"; these results have since been amply confirmed and in addition, with lapse of time, the plots are yielding other interesting information.

As measured by the effect on recent cropping it would appear that a small dressing of 10 maunds lime per acre applied to one of the plots 8 years ago has now about exhausted itself; however a plot which got 20 maunds lime at the same time is still showing a favourable effect.

Again certain plots which received very heavy lime dressing, up to 10 tons per acre, 8 years ago are still cropping well. On these plots the cowpea crop was distinctly chlorotic for a year or two after the lime was applied; this has entirely disappeared; indeed these plots may now be picked out by the brilliant deep green colour of their crops.

Basic phosphates (with the exception of Apatite and similar insoluble material) invariably beat superphosphate in the absence of lime; the effect of certain basic forms of phosphoric acid applied 7 years ago is still to be seen, whilst a plot manured with superphosphate at the same time has carried no cold weather crop at all for some years, and never did produce anything worth calling a crop.

The toxic effect of Sulphate of Ammonia without lime on this soil has frequently been insisted upon; the plots receiving recurring dressings of this manure may easily be picked out by their bareness; as a weed killer on these soils Sulphate of Ammonia should be excellent.

The superiority of nitrate of soda as a source of nitrogen in mixtures of fertilisers, the great part played by phosphoric acid especially in its basic forms, the value of organic manures, and of course the pre-eminent effect of lime, are amongst the things which this experiment has taught us.

16.—*Mineral phosphate Experiments in the cane rotation.*

Blocks A, B, D, E.—An area of about 1 acre in each of the four blocks under our cane rotation is being dressed every fourth year with flour phosphate with a view to observing its effect on the various crops in the rotation.

It is intended to work through two or preferably three complete rotations on all four blocks before generalising. So far only one such rotation has been worked through, and as a result one can only say that so far the value of this form of mineral phosphate for sugarcane is inconclusive; on the contrary it is very positive in the case of the rape crop and well marked on oats and green crops.

In paragraphs 7 and 8 of this report will be found an account of the effect of the phosphate on the ratoon and plant cane crops of the past year.

On Block E during the first and second years of the second rotation there was an average increase for the two crops of cane of $2\frac{1}{2}$ tons stripped cane per acre. In the third year of the rotation on this block the rains green crop of *Dhaincha* was manifestly better on the phosphated area, while the following are the figures per acre for the succeeding crop of oats during the cold weather of 1920-21:—

			Mds.	sts.
Phosphated area	...	...	13	24
Non-phosphated area	...	...	12	12

Block D was the area to receive phosphate this year; this is its second application, the first having been given in 1916. The crop of rape following in the cold weather 1920-21 was more than 100 per cent. better on the phosphated area.

17. *Pulse crops.*—"Para Pca", a small seeded variety of cowpea which did well on a small scale last year, was tried on a larger area on Block C, but as already noted in paragraph 12 of this report the crop was a failure owing to heavy rains after sowing and to a subsequent attack of crickets.

"Burma Bean" was grown on an area of about $\frac{1}{2}$ acre. This crop was also adversely affected by heavy rains after sowing, but eventually gave an outturn of 9 maunds seed per acre.

Four varieties of *Rahar* were grown for trial on small plots, the yields being as follows:—

"Comilla brown" ...	...	356 lbs. per acre.
"Comilla White" ...	...	648 " " "
Early variety ...	...	248 " " "
Late " ...	...	886 " " "

The late variety gave the heaviest yield, but it came to maturity so late in the season that it is doubtful whether it is suited to this locality on account of the usual heavy spring rains which make harvesting and threshing difficult. "Comilla White" which was ready for harvesting at the end of January is apparently the most promising variety. It is proposed to make further trials in the coming year.

18. *Fodder crops*.—The small plots of Guinea Grass and Rhodes Grass on Block A were trenched with cowdung between the rows during the rains, and frequent intercultivation was given with a single-bullock spring-tynd cultivator. The small area of "Sudan" grass from Australia grown from seed and planted out last year gave disappointing results as compared with the other two grasses. The results of Guinea grass and Rhodes grass are given below:—

—	Area of plot.	Outturn, April 1st to November 30th 1920.	Outturn, December 1st 1920 to March 31st 1921.	Total outturn per plot.	Total outturn per acre.
1	2	3	4	5	6
	Sq. feet.	Mds. srs.	Mds. srs.	Mds. srs.	Tons.
Guinea grass ...	3,600	75 37	9 0 $\frac{1}{2}$	84 37 $\frac{1}{2}$	37.6
Rhodes grass ...	3,240	30 1 $\frac{1}{2}$	11 22 $\frac{1}{2}$	41 24	20.4

On the year's results Guinea grass yielded almost twice as much green fodder as Rhodes grass, but Rhodes grass gave the better result during the cold weather months.

During the rains of 1919 areas of 0.25 acres of Guinea grass and 0.16 acres of Rhodes grass were planted out in Block M. The plots were manured with cowdung ploughed in between the

rows, and intercultivation was given with the spring-tined cultivator. During the year the Guinea grass yielded 8 cuttings totalling 16.3 tons of green fodder per acre, but the Rhodes grass did very badly, many of the clumps dying out.

On the whole Guinea grass appears to be the most promising fodder grass experimented with up to date. It is easily propagated and, if manured and kept clean by frequent intercultivation, will give heavy cuttings of excellent green fodder. The comparatively low outturn during the cold weather months can probably be improved by irrigation, and this point will be investigated.

19. *Extension area—Block M.*—This was under non-experimental Ratoon sugarcane which was used for planting material on the farm and for distribution. As in the case of the crop of plant cane last year, the ratoons this year were much better on the area to which 30 maunds of ground limestone per acre were applied six years ago.

Block O.—This Block was dressed with 20 maunds of ground limestone per acre. The Eastern half was cropped with sugarcane planted from selected setts of all varieties to provide planting material for the experiments with sugarcane in 1921-22. The crop made good healthy growth and provided an excellent supply of planting material. The Western half was green manured with *Dhaincha* in the rains and a crop of *Matikalai* taken in the cold weather. The green crop made good growth and was ploughed in at the end of June. The *Matikalai* yielded at the rate of 500 lbs. grain per acre.

Block N.—Was dressed with 20 maunds ground limestone per acre and remained fallow during the rains. Subsequently cowpeas for seed were sown, but the crop was poor.

Block Q.—Was planted out with Guinea grass and Rhodes grass. The Rhodes grass did so badly that subsequently it was rooted up and the whole area put under Guinea grass. During the year 840 clumps of Guinea grass were distributed from this area.

Block R.—Was green-manured with cowpeas and then sown with *Matikalai*. An experiment with Water Hyacinth ash and Basic Slag used alone and in combination was laid down on this block in 1918. This year the Basic Slag plot and the non-manured plot yielded no crop of *matikalai*, while on the water Hyacinth ash plot and on the plot treated with Hyacinth ash and Basic Slag used in combination, the yields were too poor to give any reliable information.

20. *Other crops.*—Block D was given a dressing of 20 maunds of ground limestone per acre over the whole area, and 7 maunds of flour phosphate per acre on one acre. It was then sown with cowpeas for green manure followed by a catch crop of rape which was ploughed in at the beginning of December in preparation for sugarcane. The cowpeas made excellent growth over the whole area, while the rape was twice as luxuriant on the phosphate area as on the remainder of the block.

Blocks E. and F.—Were green manured with Dhaincha followed by a crop of oats in the cold weather.

Block H.—Was dressed with 20 maunds ground limestone per acre, green manured with Dhaincha in the rains and sown with cowpeas for seed, which yielded 560 lbs. seed per acre.

21. *Orchard.*—Lichis, Pineapples and Sapotas continue to fruit well, but the lichis trees are still being attacked by a mite as reported last year. Mangoes again failed to bear fruit although they blossomed profusely. The orange trees, which at first appeared to be promising, are not doing well and have not borne fruit.

Pineapple suckers to the number of 525 were distributed during the year.

22. *Receipts and Expenditure.*—The following statement shows the receipts and expenditure for the year under report:—

RECEIPTS.		Rs.	a.	p.
Amount credited into Treasury	...	3,377	1	9
Value of seed, etc., supplied for Demonstration, etc.	...	40	0	0
Value of stock in hand (<i>Gur</i> Rs. 1,158, <i>oats</i> Rs. 300, <i>pulses</i> Rs. 108)	...	1,566	0	0
		4,983	1	9
Less value of Farm produce of previous year sold during the year	...	1,001	1	3
Net receipts	...	3,982	0	6

EXPENDITURE.

CAPITAL.				
Petty construction	...	1,473	9	1
Purchase of cattle	...	555	7	0
		2,029	0	1

RECURRING.

			Rs.	a.	a.
Establishment ...	...	...	4,781	13	8
Feed of cattle ...	...	...	496	12	9
Seeds, plants, manures and implements ..			1,956	1	9
Wages of Labourers ...	...	...	3,160	1	9
Petty repairs ...	...	...	631	0	4
Purchase and repair of furniture ...			26	13	3
Service postage and telegrams ...			25	0	0
Miscellaneous and unspecified charges ...			1,163	9	0
Total			12,195	4	6
<hr/>					
Add value of seed supplied by seed dépôt, Gaubati ...			95	2	0
<hr/>					
Grand total			14,319	6	7
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23. *Establishment*.—This consists of a Manager on Rs. 100—10—200, an Assistant Manager on Rs. 60—6—120, a clerk on Rs. 30— $\frac{4}{2}$ —50 and a peon on Rs. 11— $\frac{1}{2}$ —15. The post of Assistant Manager is new, having being sanctioned with effect from 1st July 1920. Eight apprentices are now taken on the farm for two years practical training. Two completed their training during the year and were appointed to the post of Demonstrator. Five new apprentices were admitted during the year, and two resigned. At the end of the year there were seven apprentices on the Farm, as against six at the beginning.

24. *Inspection*.—The Hon'ble the Chief Commissioner visited the Farm once during the year, and the Director of Land Records and Agriculture inspected it three times.

25. *Acknowledgment*.—I am indebted to Mr. A. A. Meggitt, Agricultural Chemist, Assam, for the paragraphs on sugarcane experiments and soil investigations, etc.

A. G. BIRT,

Deputy Director of Agriculture, Assam Valley.

**REPORT OF THE UPPER SHILLONG AGRICULTURAL
EXPERIMENT STATION FOR THE YEAR ENDING
THE 31st MARCH 1921.**

1. The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, $5\frac{1}{2}$ miles from the town of Shillong, and occupies the site of the old Model Farm which ceased to exist in 1879. The elevation of the place is 5,900 feet, *i.e.*, about 900 feet higher than Shillong town. The total area of the Farm is 366.67 acres of which a large portion is occupied by pine forest. Most of the cultivated and culturable land lies in a long narrow valley. The bottom of the valley was formerly a marsh which was of very little value for any purpose; it has recently been converted into firm pasture ground by deepening the stream which drains the valley, and opening side drains into it. The effect of this work is now showing in the considerably improved herbage which is produced.

The soil of the higher lands is a coarse reddish loam of very loose texture which can be worked with great ease. The subsoil is of a pronounced reddish colour and of great depth. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having long been under a thick growth of grass, the upper portion of the soil is a matted mass of half decayed grass-roots.

The soil of the farm is extremely poor and very little can be grown on it without the help of manure.

The greater part of the station suffers from the disadvantages of the exposed situation. The place is colder and more windy than Shillong; frosts are of very common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

2. The main objects for which the station is maintained are

Purposes of the station.	<p>(1) the trial and introduction of new varieties of potatoes which are the most important among the crops grown on the plateau of the Khasi Hills, (2) the breeding of improved strains of milch cows suitable for this tract and the cultivation of fodder crops for their up-keep. Fodder experiments have been tried from time to time, but having proved abortive, they have one after another dropped out of the programme of the farm.</p>
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Weather. 3. The following table gives the rainfall for the period under report :—
Rainfall.

—				Actual, 1920-21.	Normal.	Number of rainy days, 1920-21.
1				2	3	4
April	...	...	...	4.03	4.48	11
May	...	...	...	6.57	8.83	13
June	...	...	...	14.99	20.04	17
July	...	...	...	7.51	17.75	15
August	...	...	...	13.70	15.67	19
September	...	...	...	13.46	11.06	18
October	...	...	...	3.55	7.55	8
November	...	...	...	0.53	1.27	2
December	...	...	...	0.05	0.18	...
January	...	...	...	1.40	0.29	3
February	...	...	...	0.17	1.02	1
March	...	...	...	4.94	2.25	10
Total				71.20	90.39	117

The rainfall, though below normal, was fairly distributed and the season was, on the whole, satisfactory. The frost in the spring of 1921 was comparatively mild and the potatoes germinated well.

Summary of work. 4. The work done during the year consisted of :—

- (1) Trials of different varieties of potatoes.
- (2) Growing potatoes for seed.
- (3) Trials of new crops.
- (4) Growing of fodder crops.
- (5) Cattle breeding.
- (6) Distribution of seeds, implements, etc.

5. The total number of varieties under trial in 1920 was twenty-six. All these varieties were planted in duplicate plots of $\frac{1}{40}$ th acre each. They were planted in March and harvested in August, and winter seed was used in each case. The land was manured with 11 tons of cowdung and 823 pounds of rape cake per acre, and the crop was sprayed with Bordeaux mixture at the rate of 340 gallons per acre applied in two equal doses.

The outturns of the varieties for the last 13 years are given below :—

Statement showing the average yield per acre on duplicate plots for the last 13 years.

Variety.	1920.	1919.	1918.	1917.	1916.	1915.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last thirteen years.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. King of potatoes	Tons. 6.00	Tons. 4.81	Tons. 5.94	Tons. 4.77	Tons. 9.20	Tons. 6.33	Tons. 8.0	Tons. 6.84	Tons. 8.55	Tons. 7.37	Tons. 4.32	Tons. 3.51	Tons. 11.7	Tons. 6.73	
2. Magnum Bonum (1909)	... 4.70	4.70	4.51	5.23	9.35	6.77	7.55	6.07	8.15	5.90	4.56	3.22	10.16	6.95	
3. King Edward VII	... 3.11	4.18	2.75	3.56	7.35	4.01	6.17	4.00	8.8	6.0	2.68	3.31	9.87	4.86	
4. Khal Nainital	... 3.46	5.68	3.64	4.12	8.71	5.43	6.33	6.39	6.11	6.73	4.30	4.20	10.7	6.87	
5. Khal Round	... 1.92	4.70	2.27	2.99	5.80	4.95	4.62	4.51	4.03	4.05	3.40	3.75	9.36	4.30	
6. British Queen (1900)	... 11.35	6.29	3.33	4.75	9.12	7.36	7.10	5.60	6.04	6.96	3.40	...	...	6.54	Average of last 11 years.
7. Up-to-date	... 6.70	3.74	4.04	4.61	6.75	6.12	7.62	6.84	6.63	5.61	3.50	...	...	5.08	"
8. Magnum Bonum (1912)	... 3.02	6.07	3.33	4.95	8.91	4.03	6.54	5.72	8.23	...	...	...	...	5.81	Average of last 9 years.
9. Windsor castle	... 4.06	7.45	4.27	6.49	10.12	6.29	8.75	4.73	7.19	...	...	...	...	6.08	"
10. British Queen	... 4.86	8.10	3.01	3.0	7.95	6.10	6.95	5.23	2.66	...	...	...	...	5.20	"
11. Flour Ball	... 2.72	5.48	3.78	2.05	4.51	4.04	5.22	5.0	6.35	...	...	...	...	4.55	"
12. Imperator	... 5.41	4.84	4.60	4.88	7.86	6.84	6.73	6.14	7.74	...	...	...	...	6.11	"
13. Magnum Bonum (1915)	... 4.02	5.17	2.27	2.65	2.34	...	...	...	...	...	...	...	...	3.27	Average of last 6 years.

[illegible]

15. Windsor castle (,,)

17 Enicurus (A)

18. Euphorbia corollata (L.)

20. BALMORAL CASTLE (C.)

32. Arran Chief (..)

24. Sterling Castle (1911)

29: AFFIAN CUBOI

Of the above the following—Magnum Bonum (1908) and (1912), British Queen (1909), King Edward VII, Khasi Nainital, Khasi Round, Flour Ball and Acquisition:—have now been rejected and will not be included in the future variety trials. The trial is being continued with the remaining 18 varieties during the present year. The Darjeeling potato, which is said to give very good results in Bengal, has been included in the trial. The people of the plains generally give preference to the local varieties, because they are sticky in taste and also keep better in the plains. On the other hand they are very poor yielders. To test whether their yield could be increased by growing them in the hills in the rains and then sending them down in the winter, small quantities of the plains varieties have been procured from Sylhet and Rangpur and are being grown on the Farm. Twenty lots, of seeds were obtained in February 1916 through the kindness of Mr. Ferguson of Dhamai Tea Estate, Sylhet, of which seventeen grew satisfactorily. These have split up into 117 different types. The potatoes grown from the seeds of flour ball have also split up into 47 different types. Now that the Economic Botanist has joined, it is proposed to take up a systematic study of the different types during the coming season and select a few for trial. Mr. G. B. Hinde of Kamrup obtained 18 lots of potatoes from England in 1919 and kindly gave them to the Shillong Farm for trial. They were obtained very late and planted in May. They all germinated and a few tubers were obtained from each lot. Half of these were sent to Mr. Hinde and the rest were planted on the farm. The produce from these have been replanted during the present year.

As in the former years 50 tubers of each variety were selected at random, and examined for signs of disease. The following table gives the result of the examination in the last eleven years:—

Varieties.	Number of diseased tubers out of 50 examined.												
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.		
1	2	3	4	5	6	7	8	9	10	11	12		
King of potatoes ...	---	---	12	Nil	Nil	Nil	1	5	3	Nil	2	7	23
Magnum Bonum, 1908	---	---	6	4	2	4	2	Nil	1	Nil	4	5	4
King Edward VII	---	---	18	8	4	6	5	4	1	Nil	1	17	5
Khasi Nainital, 1908	---	---	43	16	8	4	4	8	Nil	1	6	8	8

Varieties.	Number of diseased tubers out of 50 examined.												
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.		
	1	2	3	4	5	6	7	8	9	10	11	12	
Khasi Bound, 1909	4	8	6	10	6	6	10	3	7	1	3
British Queen, 1909	12	Nil	6	4	2	8	2	...	1	9	16
Up-to-Date, 1912	4	32	16	4	1	6	4	1	...	2	17
Magnum Bonum, 1913	6	6	2	2	1	5	3	3	12
Windsor Castle, 1912	4	3	2	10	1	...	...	1	13
British Queen, 1912	4	4	3	6	1	1	3	4	7
Flour Ball, 1912	6	3	1	10	1	1	...	3	...
Imperator, 1912	22	3	3	4	6	...	2	0	13
Stirling Castle, 1915	10	...	5	9	10	
Epicure, 1915	5	1	6	3	2	
Magnum Bonum, 1915	5	1	3	2	3	
Dover Castle, 1915	4	1	4	2	6	
Up-to-Date, 1915	1	1	4	1	12	
King of Potatoes, 1915	1	...	3	17	
Windsor Castle, 1915	2	3	1	6	13	
Edinburgh Castle, 1915	3	...	...	3	2	
Acquisition	3	...	9	4	
Balmoral Castle	5	3	2	7	3	
Arran chief	2	2	3	9	

Potato manurial experiment.—An experiment designed to shed some light on the respective manurial values of rape cake and bonemeal for the potato crop is being carried out since 1916. This experiment was put down in duplicates in two series—one with King of potatoes and the other with Magnum Bonum. The

seed rate was 987 pounds per acre. The manures used and the yields obtained in 1920 are shown in the accompanying table:—

1	2	3	4	5	6	7	8	9	10	11	12
Manure used per acre.	Cowdung 5.5 tons.	Cowdung 5.5 tons, Rape Cake 823 lbs.	Rape Cake 823 lbs.	Bonemeal 823 lbs.	Cowdung 5.5 tons, Bonemeal 823 lbs.	Rape Cake 823 P., Bonemeal 823 lbs.	Lime 1.10 tons.	Cowdung 5.5 tons, Lime 1.10 tons.	Cowdung 5.5 tons, Rape Cake 646 lbs.	Cowdung 5.5 tons, Rape Cake 823 lbs.	Cowdung 5.5 tons, Bonemeal 823 lbs., Lime 1.10 tons.
King of Potatoes ...	4.51	3.95	.91	3.48	4.83	3.20	4.95	4.84	4.77	5.40	4.77
Magnum Bonum ...	4.04	4.50	3.00	3.85	4.40	5.69	2.93	4.66	7.15	4.71	5.83
Total ...	8.55	8.44	4.61	7.33	9.23	7.89	7.88	9.79	11.92	10.20	10.69
Average yield per acre ...	4.27	4.22	2.25	3.66	4.64	3.94	3.94	4.89	5.68	5.10	5.04

Bonemeal and rape cake were used not because they were considered the most suitable for the potato crop but because they are practically the only manures other than cowdung which are available in Khasi Hills. The experiment is being repeated during the present year.

6. It is the custom among the Khasi cultivators to grow an autumn crop of potatoes, principally for the purpose of using the produce for seed for the following spring crop. This custom has been followed at the farm for some years, but owing to the exposed situation of the farm it has been found that the yield of the autumn grown crop is so small as to make seed produced in this way extremely expensive. With the object of finding cheaper source of seed the method of boxing summer sets was tried. The method consists of placing the seed potatoes in shallow boxes specially made for the purpose and of storing

them in a well lighted but not too airy shed. Under conditions of moderate temperature and moisture the sets keep satisfactorily and produce short well-formed sprouts, which grow at a slow rate. These sets can be planted out from the boxes at the ordinary planting season and are then likely to grow rapidly.

During the last three years potatoes from the summer crop were placed in sprouting boxes and kept there during the subsequent cold weather. In the spring these sprouted summer sets were planted alongside the unsprouted winter sets. The size of sets and weights used per acre were approximately the same. Similar conditions of cultivation, manuring and spraying were observed for both plots and as the experiment was tried with six of the main varieties, the result may be taken as fairly conclusive.

The average of the yields obtained were as follows :—

			Weight in tons per acre.	
			Sprouted.	Winter.
1918	...	...	4.45	4.41
1919	...	...	7.26	5.58
1920	...	...	6.25	5.01

The results obtained so far are satisfactory. The experiments are being continued during the present year, and a careful record has been kept of the proportion of wastage of the summer seed during storage. But it is suspected that the produce of the summer seeds are more liable to rotting than those grown from winter seeds. Careful investigations are being conducted to test the point.

7. The six varieties of potatoes which have given the best results so far were grown during 1920, for the production of seed. The crop was planted in March and harvested in August. The total area planted was 11.65 acres.

The manure, used were, as in the previous years, 5.5 tons of cowdung and 823 pounds of rape cake per acre. The crop was sprayed once with Bordeaux mixture at the rate of 120 gallons per acre. The outturn was as follows :—

Variety.	Area in acres.	Total yield in tons
King of potatoes	2.52	5.12
Magnum Bonum	3.77	6.53
Up-to-Date	1.22	1.91
Windsor Castle	1.04	3.27
British Queen	.75	1.88
Imperator	2.35	3.88
Total	11.65	22.59

During the present year about 7 acres have been planted in March with the same six varieties. The demand from the plains for seed potatoes grown in the Shillong Farm is increasing rapidly. In order to meet this increased demand the area under this crop has been extended as far as practicable with the quantity of cattle manure which is available. Even then there is an insufficient supply for the requirements of both hills and plains districts. To still further increase the supply, arrangements were made in 1916 to cultivate an extra area of potatoes under the *jhum* system and this has been continued since. An arrangement was made with Khasi cultivators that the farm should provide the land and the seed and the cultivators should do the work and return to the farm one and a half times the seed supplied. The cultivators also undertake to sell at Bazar rates whatever additional quantity of seed may be produced. The practice has been to gradually reduce the area as *jhuming* is not a very economical system. In 1920 the farm supplied 2.55 tons and received back 8.19 tons; during the present season 2.87 tons have been supplied. In addition 4.6 tons were purchased for distribution for seed among the Khasi cultivators outside.

Although an experiment is being conducted to see how far sprouted summer seed can replace winter seed, we have still to depend on the latter very largely for farm seeds, particularly as summer seed grown with manure is ordinarily believed to be more liable to disease. As the outturn of winter crop at the farm has been always poor, arrangement was made to grow winter seed in the plots of a few Khasi cultivators at a much lower elevation. The seeds were supplied by the farm and the land and the labour by the cultivators. Half the total outturn of the plots was to be returned to the farm; 4.33 tons were issued and 2.19 tons received back under this condition. This is almost as much as the usual proportion of winter seed obtained at the farm with the additional advantage that the farm labour was almost entirely saved. The Agricultural Demonstrators supervised the harvesting to see that the outturn was accurately recorded and that the seeds were kept pure.

The total quantity of seed potatoes available was as follows:—

	Tons.
Farm grown	24.3
Winter seed returned by outside cultivators ..	2.19
Received from <i>jhum</i> grown	3.19
Total	30.31

This was disposed of as follows :—

			Tons.
Sold to cultivators ...	...	...	·67
Planted at the farm ...	...	...	11·88
Supplied for demonstration ...	...	...	13·09
Supplied to Farm-jhum grower...	...	...	2·87
Driage and rottage ...	...	...	1·80
			<hr/>
	Total	...	30·31

The driage and rottage were comparatively small. This was due mainly to the fact that the seeds were disposed of quickly and only the amount actually required for farm use was stored. This practice will always be followed in future.

Reference was made in paragraph 3 of the last year's report to the rottage, from which the potato crop suffered severely. This was believed at the time to be due mainly to unfavourable climatic conditions. The farm was visited in August by the Imperial Agriculturist, who thought that the bulk of the crop was suffering from "Ring Disease". In October, the Imperial Bacteriologist visited Shillong and examined the potatoes in the godown, as well as in the field. Representative samples were sent to Pusa and examined in the laboratory. He found them to be largely suffering from "sprain". An experiment has been started to test whether the disease spreads through seed or soil or through both, and whether liming the cut tubers will have any effect in checking the disease.

It was feared, however, that the diseases would very probably be communicated through the seed. It was, therefore, thought safe to indent an entirely fresh lot of seed from Scotland. Mr. Birt who was then on leave in England kindly selected the varieties and a lot of 5,000 pounds of the following varieties were obtained from Scotland. Up-to-date, British queen, Arran chief, Great Scott, King Edward and Allay.

Of this, 200 pounds have been supplied to the Director of Agriculture, Mysore. Two hundred pounds were more or less damaged and the balance of 4,600 pounds have been planted in the farm. The produce of this will be grown next year for seed alone, so that there will be enough for distribution in 1923.

To avoid all danger of contamination the new varieties were planted on a piece of entirely new land which never grew any potatoes before, and the farm varieties have been planted on a plot which did not grow any potatoes for the last three years.

8. Attempts to grow Naga Hill and Bhutia rice proved a failure as the paddy did not ripen before winter set in. The experiment will be given up.
- New crops.

Rhubarb.—This crop was first planted in 1912 on a plot of about $\frac{1}{10}$ th of an acre. Two additional plots have been planted since; $\frac{1}{10}$ th of an acre in 1915 and $\frac{1}{3}$ rd of an acre in 1918. The land was manured with cowdung at the rate of 11 tons and with lime at 36 tons per acre. During the year under report about 72 pounds of stalks were sold realising Rs. 17-8. The plants are getting very old and at the same time they were attacked by insect pests. As the Khasi cultivators near the town have taken to cultivating rhubarb as one of their garden crops it is no longer necessary to extend its cultivation at the farm.

Strawberries.—In September 1916 a plot of $\frac{1}{20}$ th acre was planted with two varieties of strawberries obtained from the Fruit Experiment Station, Shillong. These plants grew well and in October 1917 another $\frac{1}{10}$ th acre was planted with the suckers of those two varieties. With the plot planted in 1912 the total area at present is about $\frac{1}{10}$ th acre. About 50 pounds of fruit have been picked and sold during the year, the return from them being Rs. 35-4.

Other Fruits.—A few of the trees on the farm bore fruits.

These were sold and realised the following sums :—

				Rs.	a.	p.
Apples	...	...	...	52	12	6
Peaches	...	...	...	0	5	0
Chestnut	...	...	...	32	1	6
Plums	...	...	...	1	8	3

A few trees were obtained from the old fruit garden and planted in the farm.

Fodder Crops. 9. The following fodder crops were grown during the year:—

Name of crops.				Area sown.	Cost of cultivation.	Outturn of green fodder.
1				2	3	4
				Acres.	Rs. a. p.	Tons.
Maize	...	...	...	18.5	445 6 9	30.17
Maize Jhum area	...	...	...	1	...	20
Job's Tears	...	...	...	4	...	2.10
Total				23.5	445 6 9	32.27

The Maize crop gave a fair yield.

The whole of this fodder was made into silage and 25.03 tons or 78 per cent. was recovered as ensilage of good quality. The total cost of silage was Rs. 596-14-6 made up as follows:—

Cost of cultivation Rs. 445-6-9 and cost of carrying the fodder, chopping, and packing in the silo Rs. 151-7-9. The cost per ton of silage was Rs. 23-1-9 as compared with Rs. 25-3-6 in the previous year.

The present pit, however, is rather shallow in proportion to its width. A new pit of less width and greater depth will be dug during the year.

Raishan.—(*Paspalum Sanguinale*) has been successfully grown as a hay crop since 1912 and has proved a valuable winter food for the cattle. *Raishan* was grown on an area of 46.1 acres and the produce was made into hay and fed to the cattle during the winter months.

A total amount of about 26.39 tons of hay was fed during the year and 4.4 ton sold. The cost was Rs. 813-5-9 or a little over Rs. 30-13 per ton of hay as compared with Rs. 30-8 in 1920.

The quality of the fodder was good and eaten greedily by the cattle.

10. The half Patna cattle and the progeny of the cross with Bhutia breeds have proved remarkably well adapted to the climate of the Khasi Hills. In respect of milking capacity these cattle stand head and shoulders above any cattle on this side of India. The demand for these cattle continues keen but is still practically confined to a few people about Shillong, who are experienced in the care of cattle. The breeding bulls are generally in great demand and are disposed of as fast as they reach the age of three years, when they are considered fit for use. The demand, however, is mostly from tea planters and a few other people from the plains. The policy of keeping only two distinct herds, one of pure Patna and the other of mixed Patna and Bhutia, described in the last report, is already showing promising results. The new progeny is showing distinct improvement.

Three pure Patna bulls for breeding were sold during the year and there are several applications in our waiting list. One bull was supplied free to the Political Officer, Sadiya. The total number of animals disposed of during the year was :—

Bulls	...	...	...	...	4
Old bullock	...	...	...	...	1
Heifers	...	...	...	...	3

Three young bulls and two heifers died of dysentery and diarrhoea, one bull of black quarter and one heifer from Epilepsy. There has been some improvement in the care of the calves but a good deal yet remains to be desired.

The cost of maintaining the herd is becoming higher owing to the rise in price of all food stuffs. The cost during the year amounted to Rs. 5,428-9-11. The income from the sale of milk was Rs. 2,230-1-2 and the value of the cattle sold Rs. 391-8-5.

The total yield of milk during the year amounted to 3,969 gallons as compared with 2,302 gallons of last year, out of which 118 gallons were fed to calves and the remainder sold at the rate of 13 pounds for a rupee.

	Moolany.	Mong. Patna.	Mong. P. B.	M. P. B. P.	M. P. B. P. P.	M. Bhutia.	Patna.	Bhutia.	P. B.	P. B. B.	P. B. P. P.	P. B. P. P. P.	Patna + Khasia (K).	M. P. P.	Total on 31st March 1921.	Total on 31st March 1920.	Remarks.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Breeding Bulls ...	1	...	...	...	...	...	2	...	...	...	...	...	...	...	3	3	
Bulls 3 years and above	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bulls 1 to 2 years	...	1	2	3	...	...	...	...	...	...	...	...	...	...	6	1	
Bulls under 1 year	...	1	...	...	...	...	7	...	...	2	3	...	...	1	14	10	
Heifers 2 to 3 years	...	3	...	...	...	...	...	...	...	...	...	...	...	...	3	3	
Heifers 1 to 2 years	...	1	...	...	...	...	...	...	...	8	...	...	...	...	2	4	
Heifers under 1 year	...	...	...	...	...	...	5	...	...	...	4	1	...	1	11	8	
Cows ...	...	2	...	...	...	...	15	...	1	9	3	...	...	...	20	16	
Total on the 31st March 1921	1	8	2	3	...	...	29	...	1	12	10	1	...	2	49	...	
Total on the 31st March 1920	1	10	3	6	1	...	21	...	1	12	4	...	2	...	...	61	

Besides these there are 2 cart bullocks and 12 plough bullocks which include 3 purchased during the year.

11. The following seeds and plants were sold from the farm to the cultivators during the year—

	Tons.	Number.
Seed potatoes
Rhubarb roots	...	36
Pear grafts	...	46
Chestnut seedling	...	1
Apple graft	...	1

13.02 tons of seed potatoes were also distributed to cultivators outside on the return system. 4.5 tons of seed potatoes were purchased from the farm *jhum* growers and sent to the plains.

12. U Herrick Singh continued as Farm Manager and U Shetro Mohan, Jyrwa as Farm clerk throughout the year.

Establishment.

U Melachithon completed his period of apprenticeship on 31st March 1921 and is going back to his own cultivation. One L'Imellya of North Cachar is working as an apprentice with a view to his taking up work in North Cachar Hills. A. Lushai Demonstrator completed his training and returned to the Lushai Hills in the middle of September 1920. Another Lushai apprentice has been deputed for training in December 1920.

Receipts and expenditure. 13. The total receipts and expenditure are shown below :—

			Rs.	a.	p.
<i>Receipts—</i>					
Sale of milk	...	...	2,230	1	2
Sale of cattle	...	...	391	8	5
Sale of potatoes	...	...	75	4	0
Miscellaneous	...	...	193	10	3
			<hr/>		
Price of 410 maunds of potatoes supplied for demonstration.			2,590	7	13
			1,230	0	0
			<hr/>		
Total	...	...	4,120	7	10
<i>Expenditure—</i>					
<i>Capital expenditure—</i>					
Purchase of cattle	...	...	100	0	0
Petty construction	...	...	1,095	0	4
Reclamation	...	...	49	13	6
Purchase of machinery instruments	...	...	42	8	0
			<hr/>		
Total	...	...	1,287	5	10
<i>Recurring—</i>					
Establishment...	...	...	3,361	0	0
Feed of cattle	...	...	4,248	8	0
Seeds, plants and manure	...	...	1,692	5	3
Wages of labourers	...	...	4,143	12	6
Petty repairs	...	...	897	9	5
Purchase and repairs of furniture	...	...	13	10	6
Service, Postage and Telegrams	...	...	30	0	0
Stationary purchased in the country	...	...	3	10	0
Unspecified charges	...	...	642	12	9
			<hr/>		
Total	...	...	15,033	4	5
			<hr/>		
Grand Total	...	...	16,320	10	3
			<hr/>		

J. N. CHAKRAVARTY,

Deputy Director of Agriculture,
Surma Valley.

Upper Shillong Farm, }
The 3rd April 1921.

REPORT OF THE FRUIT EXPERIMENT STATION,
SHILLONG, FOR THE YEAR ENDING THE 31ST
MARCH 1921.

1. *Introductory*.—The Fruit Station commenced work in October 1912: the first trees were planted in 1913. The land is situated on the south side of the Jowai road, distant about a mile from Shillong station, the elevation is about 5,100 feet. The total area of the station is 62·6 acres, of which about 30 acres is suitable for fruit growing: 28½ acres have been planted.

2. *Lower Garden*.—No extension to this block has been made since 1913-14. The planted area is 4½ acres in grounds of 6·13 acres: the fruit trees are planted 15'×15' diagonally. The soil of this plantation varies from light sandy loam lying above boulders to heavier loam of good depth. The following varieties of apples may be added to those given in last year's report as showing promise of success: Norfolk Beauty, Wealthy, Crimson Bramley, Upton Pyne, Rev. W. Wilks, Newton Wonder, Potts Seedling, Red Victoria, Golden Reinette, Star of Devon, &c. &c. The Rymer standard trees again bore good crops considering the size of the trees. None of the standard trees obtained from Kashmir have yet fruited. The Pear trees show improvement in growth from the top dressings of good soil and bonemeal. The following are the most promising varieties in this garden:—Fertility, Fondante de Thirriat, Beurre d' Amandis, Marie Louise d' Uccle, Beurre Diel, Beurre d' Anjou. Of the others Emile Heyst, Clapps Favourite, Red October, Parrot, Seedling Bergamot, Beurre Naghan, Precoce de Juillet show little promise of being successful. Peregrine, Kestrel, and Duke of York Peaches are the only varieties planted that can be called successful, the fruit of these is quite first class and ripens on the trees. None of the Orange trees have yet fruited. The Cherry trees as reported last year are a failure in this Garden, the soil being unsuitable. The Plums with the exception of the Japanese variety Satsuma which bore excellent fruit, show no improvement. The Merryweather Damson and the Langley Bullace may be planted with certainty of bearing valuable fruit. No better Berry than the Blower Blackberry, an American variety, can be grown, and its success is established. Cockchafer grubs and beetles were destroyed in thousands during May and June—other pests were controlled by spraying and other means.

3. *Upper Garden*.—The area planted is $21\frac{1}{2}$ acres, of which $10\frac{1}{2}$ acres was planted in 1914, 2 acres in 1915, $\frac{1}{2}$ an acre in 1916, $5\frac{1}{4}$ acres in 1917, $2\frac{1}{4}$ acres in 1918, 4 acres in 1919. It is divided into 7 blocks, viz.:—

Top block.—Area $1\frac{3}{4}$ acres, planted in 1914 with Bush Apple trees $15' \times 15'$ diagonally.

North block.—Area $1\frac{1}{2}$ acres, planted in 1914 with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$.

South block.—Area $5\frac{1}{4}$ acres, planted with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple, Pyramid Pear, Cherry and Plum trees $15' \times 15'$, $\frac{3}{4}$ acre planted in 1914, $\frac{1}{4}$ acre in 1915, $\frac{1}{2}$ acre in 1916, $2\frac{3}{4}$ acres in 1917, 1 acre in 1918.

East block.—Area $8\frac{1}{4}$ acres; 7 acres is planted with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$; $5\frac{1}{2}$ acres planted in 1914, $1\frac{1}{2}$ acres planted in 1915. The remaining $1\frac{1}{4}$ acres was planted in 1918 with Standard Pear trees $25' \times 25'$ diagonally.

South-west block.—Area 4 acres, planted in 1919 with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple and Plum trees $15' \times 15'$ in 1919 and 1920.

East block extension.—Area $2\frac{1}{2}$ acres, planted in 1917 with Standard Apple trees $30' \times 30'$ diagonally, interplanted with Bush Apple trees $15' \times 15'$.

West block.—Area $1\frac{1}{4}$ acres, planted with Standard Pear trees $25' \times 25'$ diagonally, interplanted with Bush Pear trees $12' 6" \times 12' 6"$; 1 acre planted in 1914, $\frac{1}{4}$ acre in 1915.

The soil of the Upper Garden is a good loam of about 12 inches depth lying on a red sub-soil. Small plots have a hard pan sub-soil about $2\frac{1}{2}$ feet from the surface. The whole of the planted area has been terraced with stone and banks. This has successfully prevented the denudation of the soil by rainfall.

The following statement shows the varieties of the Apples and Pears grafted : Every tree was transplanted and the weakly and the badly grown ones thrown away :—

Varieties and Stock.	North block.	Top block.	East block.	West block.
1	2	3	4	5
APPLES GRAFTED ON CRAB STOCK.				
Bismarck	200	...	62	...
James Grieve	640	...	135	...
Kerry Pippin	70	...	93	...
Lane's Prince Albert ... ..	...	...	34	...
Rev. W. Wilks	60	83	16	...
Stirling Castle	48	...	...	...
Red Victoria ... ..	...	...	34	...
Crimson Bramley's Seedling ... ..	...	...	56	...
Bramley's Seedling ... ..	...	...	30	...
Alfriston ... ..	...	...	151	...
Bens Red ... ..	...	...	72	...
Rival ... ..	...	...	95	...
Domine ... ..	...	...	102	...
Norfolk Beauty	75	...	...	...
Total	1,093	83	887	0
APPLES GRAFTED ON PARADISE STOCK.				
Bismarck ... ..	...	...	56	...
James Grieve ... ..	...	...	150	...
Kerry Pippin ... ..	...	...	100	...
Rev. W. Wilks ... ..	...	...	76	...
Devon Queen ... ..	...	...	53	...
Barnack Beauty ... ..	...	...	33	...
Elhison's Orange ... ..	...	...	34	...
Total ... ..	...	...	502	...

Varieties and Stock.	North block.	Top block.	East block.	West block.
1	2	3	4	5
PEARS GRAFTED ON PEAR STOCK.				
Fertility	352
Marguerite Marillat	50
Fondante de Thirriot	41
Bartlett	97
Total	540
PEARS GRAFTED ON QUINCE STOCK.				
Moyenne du Comice	81
Madame Treve	13
Mouise Bonne of Jersey	52
Marguerite Marillat	41
Fondante de Thirriot	49
Vincent	73
William bon Chretien	69
Bartlett	184
Lincoln	11
King Karl	3
Howell	18
Alphonse	14
Richards	12
Triumph	15
Howbrook	6
Total	631

The varieties of Apples that may be added to those given in last year's report as showing promise of being successful are :—Wellington, Crimson Bramley, Rival, Bens Red, Ellison's Orange, Charles Eyre. The Pear trees show the same improvement from top dressings as those in the Lower Garden—the most promising varieties are Fertility, Louise Bonne of Jersey, Princess, Beurre d'Amanlis, William Bon Chretien (named Bartlett in America), Durondean, Beurre Capiaumont, Jules Guyot, Marguerite Marillat, Doyennedü Comice, Beurre Fonqueray. Several of the American varieties are growing well, but have not yet fruited. The Japanese plums Satsuma, Botan, Burbank bore good crops of fruit and may be planted with confidence of success. Some of the trees of the English varieties put on growth, but only a few bore an odd plum here and there. The English stock does not appear to be suitable to the country and nurseries of local wild plum seed have been planted as stock. The Cherry trees in the South Block continue to grow well and the French varieties Gros Coeuret, Royale, Pelisser, Noire des Vosges and the English varieties Kentish, Morello, Burbank are very promising. The Strawberries planted in the South-west block bore a good crop. During the year Methylated Spirit was used against the attack of the woolly Apple Aphis commonly known as American blight. During the cold weather months all branches and shoots of the trees attacked were cut off and burnt on the spot by coolies following behind the pruners, and where suspected, the roots were opened out and the parts attacked, similarly treated. It is a very injurious disease and yet at the same time is open to remedy. The presence of this Apple bark plant louse may be easily detected by the cottony growth on the insects giving the appearance of a white film. When there are many, it appears as if a knot of cotton wood were sticking to the bough or even hanging loose. Methylated Spirit and anything oily, greasy, or sticky, well rubbed on, and which by adhering for a time will choke the Aphides that it touches, is the remedy. Tobacco solution was tried on the roots of trees attacked, and appears to have been successful in stopping it. Spraying with Arsenate of Lead kept the small black weevils in check—this pest did a lot of damage last year, and as was feared would be the case, the injury to the foliage resulted in a stunted growth, and poor crops, from the trees attacked, it being particularly noticeable in the variety James Grieve.

The following Standard Apple trees were distributed during the year :—

Mr. Morgan's garden, Shilling—Three each of the varieties Delicious, Domino, Rival, Alfriston, Bramley's Seedling, James Grieve, Kery Pippin.

Mr. R. K. Das's garden, Laban, Shillong.—One each of the varieties Domino, Rival, Alfriston, Bramley's Seedling.

Mr. J. R. Cunningham's garden, Shillong.—Two each of the varieties, Bismarck, Kerry Pippin, James Grieve, Rival Delicious, Worcester Pearmain.

Mr. W. Warren, Margherita, Assam.—Two Worcester Pearmain.

Mr. E. W. Dunn's garden, Upper Shillong.—One each of the varieties, Domino, Rival, Alfriston, Bramley's Seedling.

Babu Devendra Kishore Dhar's garden, Shillong.—One each of the varieties Delicious, Worcester Pearmain.

Siem of Nongkhlat, Maxnai, Khasi Hills.—Two each of the varieties, Grimes Gullen, Delicious, King David.

Jowai Dák-bungalow garden, Jowai, Khasi Hills.—Six Delicious, 2 Senator.

Catholic Mission garden, Boliang, Khasi Hills.—Four Delicious, 2 King David, 2 Senator.

Mr. W. L. Scott, Aijal, Lushai Hills.—Six Delicious, 2 Champion, 2 King David, 2 Black Ben.

The following trees are in Nurseries for future planting and distribution :—

Description.	South Block.	East Block.	South-west Block.	Total.
1	2	3	4	5
Standard Apple trees	9	97	115	221
Standard Pear trees . . . . .	...	40	32	72

The following trees purchased this year for replanting varieties that fail in future years, have been planted in Nurseries :—

376 Standard Apple trees, 146 Bush Apple trees.

59 Standard Pear trees, 14 Bush Pear trees.

6 Cherry trees, 20 Damson trees.

16 Peach trees, 5 Fig trees.

The establishment consists of an Overseer, a part-time Clerk and 10 Khasi Malis. All have worked well and take great interest in their work.

4. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted :—

Species of fruit trees.	Variety.	Planted, 1913-20.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees ...	James Grieve ...	59	78	140	57	...	40	...	372	Bush.
	Boston Russet ...	...	2	10	...	...	...	...	12
	Bons Red ...	...	...	10	10	...	0	...	29
	Alfriston ...	...	...	29	...	...	12	...	41
	Egremont Russet ...	10	...	...	6	1	...	...	19
	Annie Elizabeth ...	...	...	19	...	...	...	...	19
	Claygate Pearmain ...	7	...	...	10	...	...	...	17
	Lord Hindlip ...	...	...	10	...	...	...	...	10
	Mannington Pearmain ...	6	...	...	8	2	4	...	20
	Winter Queening of Kent.	...	...	10	...	...	...	...	10
	Pineapple Russet ...	...	...	...	9	...	...	...	9
	Edward VII ...	...	...	7	...	...	...	...	7
	Red Juneating ...	6	...	1	2	...	3	...	17	
	Flower of Kent ...	...	...	3	...	...	...	...	8
	Cornish Pine ...	1	13	...	...	...	...	...	14
	Tower of Glamis ...	...	...	...	...	6	...	...	6
	Winter Banana ...	...	...	...	...	3	...	...	3
	Wolf River ...	...	...	...	...	3	...	...	3
	Chelmsford Wonder ...	...	...	...	...	6	...	...	6
	Eylford Wonder ...	...	...	...	...	10	...	...	10
	Buddy ...	...	...	...	...	5	...	...	5
	Ormeau Pearmain ...	...	...	...	...	5	...	...	6
	Hambledon deux ans ...	...	...	...	...	4	...	...	4
	Belle de Fontaine ...	...	...	...	...	5	...	...	5
	Barnack Beauty ...	...	...	...	6	6	5	...	19
	Madras field ...	...	...	...	...	...	...	1	1

Species of fruit trees.	Variety.	Planted, 1913-21.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Coronation	...	...	6	4	...	3	...	13	
	Wealthy	...	...	...	4	...	6	...	10	
	Feltham Beauty	...	...	9	...	...	...	...	9	
	Norfolk Beauty	...	8	32	...	10	...	9	10	69
	Sanspareil	...	...	3	...	...	...	...	...	3
	Guelph	...	...	1	...	...	...	...	...	1
	Peacemaker	...	...	1	...	...	...	...	...	1
	Roseberry	...	...	2	...	...	...	...	...	2
	Christmas Pearmain	...	...	10	...	...	...	...	...	10
	Yorkshire Beauty	...	5	...	...	1	...	...	...	6
	Kings Ace Pippin	...	...	6	...	...	...	...	...	6
	Crimson Bramley	...	13	...	15	...	...	5	...	35
	Royal Snow	...	...	10	...	...	...	...	...	10
	Bramley's Seedling	...	15	...	15	...	...	13	...	43
	Kings of Tompkins County.	...	1	...	7	2	...	...	...	10
	Houblon	...	...	...	6	...	...	...	...	6
	Roundway Bonum.	...	6	...	...	...	...	4	...	10
	Wellington	...	...	...	5	...	...	...	...	5
	Lane's Prince Albert	...	14	2	16	...	10	11	300	353
	Upton Pyne	...	1	4	6	...	23	6	...	43
	Devon Queen	...	6	1	2	...	3	...	...	9
	Reown	...	...	4	...	...	6	...	...	10
	Stirling Castle	...	10	...	10	...	...	...	...	20
	Golden Russet	...	...	...	6	...	...	...	...	6
	Charles Ross	...	10	...	10	...	11	...	...	31
	Bismarck	...	...	1	16	8	...	19	...	44
	Eymer	...	...	6	...	...	...	...	...	6
	Warner's King	...	...	...	...	...	...	11	...	11
	Thomas Rivers	...	10	...	...	...	...	...	...	10
	Grenadier	...	...	1	13	...	...	3	...	17
	Rev. W. Wilks	...	19	...	6	...	8	10	61	110
	Houmalow Wonder	...	...	1	19	...	...	6	...	26

Bush.

Species of fruit trees.	Variety.	Planted, 1873-21.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Newton Wonder	15	...	21	16	...	52	East.
	Red Victoria	...	5	10	...	3	10	...	28	
	Potts' Seedling	4	...	5	...	...	10	...	19
	Hector McDonald	...	...	20	...	...	10	...	30
	Emperor Alexander	...	9	...	...	...	...	...	9
	Saundersham	...	...	...	...	5	...	...	5
	Rougemont	...	...	...	...	6	...	...	6
	Hamblins Seedling	...	...	...	...	8	...	...	8
	Gabalva	...	...	...	...	8	...	...	8
	Baron Wolsely	...	...	...	...	6	...	...	6
	Loddington Seedling	...	...	...	...	6	...	...	6
	Parroquet	...	...	...	...	8	...	...	8
	Domino	...	14	...	...	...	...	...	14
	Rival	...	...	...	16	...	11	...	27
	Wadhurst Pippin	...	10	...	...	...	...	...	10
	Court Penda Plat	...	6	...	8	...	...	...	14
	Ecklinville Seedling	...	4	...	4	...	...	...	8
	Early Red Margaret	...	...	...	10	...	...	...	10
	Gascoyne's Scarlet	...	4	...	5	...	...	...	9
	Spitzenberg	...	...	...	8	...	...	...	6
	Braddicks Nonpareil	...	6	...	...	...	...	...	5
	White Nonpareil	...	10	...	...	...	...	...	10
	Baumann's Reinette	...	6	12	8	...	4	...	30	
	Pitmanston Pinesapple	...	10	...	...	...	...	...	10
	Brownlee's Russet	...	3	...	...	...	...	...	3
	Starmer Pippin	...	5	6	12	...	...	19	42
	Cardinal	...	...	...	9	1	...	...	10
	Emmett Early	...	...	2	11	...	8	...	21
	Langley Pippin	...	...	...	10	...	...	...	10
	Wagener	...	...	...	9	...	...	...	9
	Williams' Favorite	...	10	...	...	...	...	...	10
	Scarlet Nonpareil	...	...	...	9	...	...	6	16
	Cox's Pomona	...	...	...	...	...	...	...	25

Species of fruit trees.	Variety.	Planted, 1912-21.							Total number.	Description.
		Upper garden.					Lower garden.	South west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Lord Burghley ...	1	4	1	...	6	Bush.
	St. Everard ...	...	6	...	...	4	...	...	10
	Beauty of Bedford ...	...	4	...	...	8	...	...	12
	Reinette doree de Heusinger ...	10	...	...	...	...	...	...	10
	Cox's Golden Drop ...	...	...	...	...	...	5	...	5
	Cox's Orange Pippin...	...	6	...	...	...	14	...	20
	Kerry Pippin ...	...	10	15	...	...	10	99	134
	Golden Reinette ...	...	...	...	...	...	7	25	32
	Peargood's Nonsuch...	...	...	25	...	...	12	...	37
	Fearn's Pipp'n ...	...	...	12	...	...	6	...	18
	Lady Sudeley ...	...	...	19	...	...	10	...	29
	Devonshire Quarrenden	...	...	...	...	...	14	...	14
	May Queen ...	...	10	...	...	...	...	...	10
	Royal Jubilee ...	...	10	...	...	...	...	...	10
	Missing Link ...	...	1	...	...	...	...	...	1
	Crawley Beauty ...	...	1	...	...	...	...	...	1
	Mrs. Phillimore ...	...	...	...	...	6	...	...	6
	Lord Grosvenor ...	...	...	...	...	6	...	...	6
	Blue Pearmain ...	...	...	...	...	4	...	...	4
	Jefferson ...	...	...	...	...	7	...	...	7
	Star of Devon ...	...	...	...	...	19	6	...	25
	Yellow Ingestre ...	...	...	...	...	...	6	...	6
	Ardeairn Russet ...	...	7	6	1	11	5	...	30
	Allington Pippin ...	...	16	5	...	...	4	...	25
	William Crump ...	...	10	19	...	10	5	...	44
	Worcester Pearmain...	...	...	...	...	...	6	...	6
	Herring's Pippin ...	4	4	3	...	49	1	...	61	
	Beauty of Bath ...	...	5	5	...	...	1	...	11
	Ellison Orange ...	...	...	...	...	15	1	...	16
Ribston Pippin ...	...	4	...	...	...	5	...	9	
Charles Eys ...	...	...	3	...	16	1	...	20	

Species of fruit trees.	Variety.	Planted, 1913-21.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Syke House Russet	6	...	6	} Bush.
	Spring Ribston Pippin	8	8	
	Mr. Gladstone	6	5	...	11	
	Golden Spire	13	9	22	
	Rosemary Russet	6	6	...	12	
	Duke of Devonshire...	...	6	6	
	Early Peach	10	10	
	Newtown Pippin	2	8	6	...	16	
	American Mother	10	10	
	Encore	16	4	...	20	
	Irish Peach	5	6	
	Lord Stradbroke	6	6	
	Total ...	340	318	763	141	562	416	521	2,551	
	Encore	6	5	11		} Standard.
Crimson Bramley ...	...	5	3	10	...	...	...	18
Rymer ...	...	...	...	...	...	8	...	8
Bramley's Seedling ...	...	...	8	12	...	1	...	21
Court of Wick ...	...	...	6	...	...	...	...	6
Irish Peach ...	...	...	...	6	...	...	...	6
Northern Greening ...	...	...	...	...	...	7	2	9
Norfolk Barding ...	...	...	...	6	...	...	...	6
Newton Wonder ...	...	4	21	...	...	...	...	25
Stirling Castle ...	...	...	4	1	...	2	2	9
Allington Pippin ...	...	...	...	...	...	1	2	3
Annie Elizabeth ...	...	...	...	...	8	...	1	10
Ell-on's Orange ...	...	...	...	...	6	...	4	10
Chelmsford Wonder...	...	...	...	...	6	...	...	6
Lord Grosvenor ...	...	...	...	...	7	...	1	8
Christmas Pearmain..	...	...	...	...	10	...	...	18
Baldwin ...	...	6	...	...	...	0	5	22
Royal Jubilee ...	...	...	...	...	...	...	1	1

Species of fruit trees.	Variety.	Planted, 1913-21.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Beauty of Kent	5	5	Standards.
	Duchess of Oldenburg ...	...	...	6	...	...	...	...	6
	Norfolk Bearer ...	...	...	5	1	...	...	...	6
	King of Tompkin's County.	...	...	6	...	...	...	...	6
	Emperor Alexander ...	...	...	...	6	...	...	...	6
	James Griere ...	...	3	16	...	...	...	...	19
	Cox's Pomona ...	...	...	2	4	...	...	...	6
	Small's Admirable ...	...	...	6	...	...	...	...	6
	New Hawthorden ...	...	...	4	...	...	...	...	4
	Calville St. Saumur ...	...	7	...	...	...	7	...	14
	Reinette de Cozy ...	...	8	...	...	...	4	...	12
	Precoc David ...	...	3	...	...	...	1	...	4
	Kashmir Amroo ...	...	3	...	...	...	...	...	3
	Fenol Net Gris ...	...	4	...	...	...	...	5	9
	Api Petit ...	1	4	1	...	...	3	...	9
	Delicious (Starks) ...	...	63	16	1	...	1	...	71
	King David ...	...	26	13	...	...	...	36	75
	York Imperial ...	...	...	6	...	...	...	...	6
	Paragon Winesap (Starks).	...	...	5	...	...	...	...	5
	Jonathan (Starks) ...	...	2	8	...	...	...	...	8
	Black Ben (..)...	...	20	5	...	...	...	35	60
	Stayman Winesap (Starks).	...	...	6	...	...	...	18	24
	Senator (Starks) ...	...	...	5	...	...	...	...	5
	Grimes Golden (Starks)	...	12	5	...	...	...	12	29
	Summer Champion (Starks).	...	3	...	...	...	...	...	2
	McIntosh Red (Starks)	...	...	1	...	...	...	...	1
	Mother (Starks) ...	...	...	6	...	...	...	...	6
Emmoth Early ...	...	...	2	...	...	...	...	9	
Baumann's Reinette...	...	...	10	...	...	...	...	10	
Grenadier ...	...	...	8	...	...	...	...	8	
Cox's Orange Pippin...	...	...	14	...	...	...	...	14	

Species of fruit trees.	Variety.	Planted, 1913-21.							Total number.	Description.
		Upper garden.					Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	11
Apple trees	Red Victoria	5	8	Standard.
	Blenheim Orange	...	3	7	...	...	...	...	10
	Calville Blanc	...	...	6	...	...	...	...	6
	Norfolk Beauty	...	16	14	...	3	1	...	24	
	Reinette du Canada	...	6	...	...	...	2	3	11
	Winter Greening	...	8	...	...	...	...	...	8
	Rev. W. Wilks	...	4	...	...	21	9	3	37
	Lord Burghley	...	5	...	...	...	...	...	5
	Lady Henniker	...	4	5	...	...	...	...	9
	Golden Spire	...	4	5	...	...	...	...	9
	Bismarck	...	4	5	...	...	...	...	9
	Calville Rouge d'hiver	...	6	...	...	1	18	10	33
	Charles Ross	...	3	2	...	4	1	6	16	
	Lord Derby	...	...	...	...	...	...	8	8
	Barnack Beauty	...	...	1	...	6	3	4	14
	Herring's Pippin	...	3	...	...	16	...	...	19
	Rival	...	2	...	...	6	...	7	15
	Star of Devon	...	...	...	...	4	...	2	6
	William Crump	...	...	...	...	8	...	...	8
	Upton Pyne	...	...	...	...	15	...	5	20
	Early Melon (Starks)	...	...	5	...	...	...	...	5
	Wealthy ( " )	...	...	2	...	...	...	...	2
	Wilson's Red June (Starks).	...	...	6	...	...	...	...	6
	Liveland Raspberry (Starks).	...	...	6	...	...	...	...	6
	Worcester Pearmain	...	...	...	...	...	4	...	4
	Tower of Glamis	...	...	...	...	...	...	6	6
	Total	...	1	245	267	47	119	80	156		945
Blenheim Orange	11	11	Horizontal trained.
James Grieve	...	...	...	...	...	...	3	...	3
Feltham Beauty	...	...	...	2	3	...	...	...	5
Lady Sudeley	...	2	...	...	...	...	1	...	3
Herring's Pippin	...	...	...	2	1	...	2	...	5

Species of fruit trees.	Variety.	Planted, 1913-21.						Total number.	Description.
		Upper garden.					Lower garden.		
		Top block.	South block.	East block.	North block.	East extension.			
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Gascogne's Scarlet ...	3	3	Horizontal trained.
	Charles Ross ...	3	...	...	...	...	...	3
	Brownless Russet ...	3	...	...	...	...	2	5
	Baumann's Reinette ...	3	...	...	...	...	...	3
	Beauty of Bath ...	...	...	...	...	...	4	4
	Sturmer Pippin ...	6	...	...	...	...	...	6
	Cox's Orange Pippin ...	...	...	...	...	...	1	1
	Cox's Pomona ...	1	...	...	...	...	3	4
	King of the Pippins ...	...	...	3	...	...	2	5
	Kerry Pippin ...	...	...	...	...	...	1	1
	Claygate Pearmain ...	...	...	...	...	...	1	1
	King of Tompkins County ...	...	...	3	...	...	...	3
	Sterling Castle ...	...	...	...	...	...	3	3
	Total ...	21	...	10	15	...	23	69	
	Sturmer Pippin	3	3	Upright trained.
	Mannington Pearmain ...	...	...	...	3	...	...	3
	Scarlet Golden Pippin ...	...	...	...	...	...	2	2
	Washington ...	2	...	2	2	...	...	6
	Allington Pippin ...	...	...	...	...	...	2	2
	Golden Spire ...	...	...	2	...	...	...	2
	Beauty of Bath ...	...	...	...	...	...	2	2
	Adams Pearmain ...	2	...	...	1	...	...	3
	James' Grieve ...	...	...	...	...	...	2	2
	King of the Pippins ...	...	...	1	1	...	...	2
	Barnack Beauty ...	...	...	...	...	...	2	2
	King of Tompkins County ...	...	...	...	5	...	...	5
	Total ...	4	...	6	15	...	10	34	

Species of fruit trees.	Variety.	Planted 1913-21.							Total number.	Description.
		Upper garden.					Lower garden.			
		Top block.	South block.	East block.	North block.	East extension.				
1	2	3	4	5	6	7	8	9	10	
Apple trees ...	Charles Ross	6	5	Palmette Verrier trained.	
	Rival	...	...	5	...	...	...	5
	James Grieve	...	...	5	...	...	...	5
	Blenheim Orange	...	...	6	...	...	...	6
	Total	22	22	Fan trained.	
	Baumann's Reinette	...	4	...	...	...	...	4
	Golden Spire	...	1	...	...	...	...	1
	Total	...	5	...	...	...	...	5
	Rival	3	3	Double Cordon.	
	Total	...	...	3	...	...	...	3
	Rival	3	3	Single Cordon.	
	Total	...	...	3	...	...	...	3

species of fruit trees.	Variety.	Planted, 1913-21.					Total number.	Descrip- tion.
		Upper grad-n.				Lower garden.		
		Top block	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
ear trees	Fertility	53	1	...	19	73	Bush and Pyramid.
	St. Swilhius ...	...	...	...	...	8	8
	Beurre Hardy ...	...	17	1	...	2	20
	Red October ...	...	...	...	...	9	9
	Beurre d' Anjou ...	...	5	...	...	...	5
	Parrot ...	...	...	...	...	9	9
	William's Bon Chre- tion.	...	13	...	...	...	13
	Seedling Bergamot ...	...	...	...	...	5	5
	Fondante Thiriot ...	...	14	1	...	10	25
	Dr. Hogg ...	...	...	...	...	7	7
	Triomphe de Vienne...	...	6	...	...	...	6
	Beacon ...	...	...	4	...	1	5
	Beurre de Nagan ...	...	...	...	...	3	3
	Charles Ernest ...	...	12	...	...	...	12
	Roosevelt ...	...	...	...	...	6	6
	Doyenne d' Ete ...	...	9	...	...	...	9
	Blickling ...	...	...	...	...	6	6
	Gansels Bergamot ...	...	5	...	...	...	5
	Santa Claus ...	...	...	...	...	5	5
	Josephine de Matines ...	...	6	...	...	9	15
	Precoce de Juillet ...	...	...	...	...	5	5
	Dr. Jules Guyot ...	...	11	...	...	6	17
	Madame Treys ...	...	...	...	...	10	10
	Durondeau ...	...	6	1	...	3	10
	Hesse ...	...	5	...	...	14	19
	Beurre d' Amanlis ...	...	13	...	...	10	23
	Emile d' Heyst ...	...	5	...	...	10	15
	Marie Benoist ...	...	6	...	...	...	6
	Clapp's Favourite ...	...	5	...	...	5	10
	Louise Bonne of Jersey ...	...	1	39	...	...	40
	President Barabe ...	...	5	...	...	...	5
	Thompson ...	...	6	...	...	...	6
	Winter Nelis ...	...	4	...	...	...	4
	Marguerite Marillat...	...	6	6	...	...	12
	Seckle ...	...	...	6	...	...	6
	Beurre Fonqueray ...	...	...	5	...	...	5

Species of fruit trees.	Variety.	Planted, 1913-21.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
Pear trees	Directeur Hardy	5	5	Bush and Pyramid.
	Colmar d' Eto ...	...	6	6	...	...	12
	Princess ...	...	6	6	...	...	12
	Belle Julie ...	...	6	6	...	...	12
	Doyenne du Comice ...	...	1	4	...	...	5
	Total	233	90	...	102	485	
	Beurre Hardy	13	5	18	Single.
	Clapp's Favourite ...	...	10	...	...	...	10
	Daroudeau ...	...	9	...	...	...	9
	Madame Treys ...	...	10	...	5	...	15
	William's Bon Christian ...	...	5	...	...	3	8
	Marguerite Marillat ...	...	14	...	...	5	19
	Doyenne du Comice ...	...	10	...	...	4	14
	Fondante Thiriot ...	...	...	...	5	...	5
	Louise Bonne of Jersey ...	...	10	...	...	...	10
	Conference ...	...	9	...	...	5	14
	Emile d' Heyst ...	...	9	...	...	...	9
	Winter Nellis ...	...	5	...	...	...	5
	Fondante d' Automne ...	...	...	...	5	...	5
	Beurre Superfin ...	...	...	...	...	5	5
	Princess ...	...	...	...	5	5	10
	Beurre Fouquieray ...	...	...	...	5	...	5
	Beurre D'el ...	...	...	...	...	5	5
	Directeur Hardy ...	...	...	...	4	...	4
	Beurre d' Anjou ...	...	...	...	...	5	5
	Colmar d' Eto ...	...	...	...	5	...	5
	Total	101	34	...	43	180	
	Directeur Hardy	5	5	10	Horizontal trained.
	Duchess d' Angouleme ...	...	1	...	...	...	1
	Clapp's Favourite ...	...	2	...	...	...	2
	Josephine de Malines ...	...	1	...	...	...	1
	Emile d' Heyst ...	...	2	...	...	...	2
	Louise Bonne of Jersey ...	...	1	...	...	...	1

No. of trees.	Variety.	Planted, 1913-21.					Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block.	South block.	East block.			
1	2	3	4	5	6	7	8	9
	Beurre Superfin	1	1	Horizontal trained.
	Princess ...	...	6	...	...	...	8
	Conference ...	...	2	...	...	...	2
	Dr. Jules Guyot ...	...	2	...	...	...	2
	Durondeau ...	...	1	...	...	...	1
	Pittaston Duchess ...	...	1	...	...	...	1
	Fondante d'Automne...	...	1	...	...	...	1
	Doyenne du Comice...	...	2	...	...	...	2
	Winter Nellis ...	4	...	...	...	...	4
	Marguerite Marillat	5	5	Standards.
	Total ...	4	33	5	...	...	42
	Kashmir ...	...	...	...	9	...	9
	Kalifer ...	...	...	...	1	1	2
	Marguerite Marillat...	...	...	6	...	...	6
	King Karl (Starks) ...	...	...	1	3	1	5
	Anjou ( " ) ...	...	1	...	6	1	8
	Lincoln ( " ) ...	...	3	...	6	...	9
	Howell ( " ) ...	...	3	...	5	...	8
	Duchess ( " ) ...	...	2	...	1	...	3
	Bartlett ( " ) ...	...	8	...	2	...	10
	Seckle ( " ) ...	...	3	...	2	...	5
	Marie Louise ...	...	2	...	...	...	2
	Dr. Jules Guyot ...	...	7	11	...	...	18
	Conference ...	...	2	4	...	...	6
	Emile d' Heyst ...	...	2	1	...	...	3
	Madame Troyve ...	...	7	...	...	...	7
	Count de Lamy ...	...	3	...	...	...	3
	Louise Bonne of Jersey ...	...	2	...	...	...	2
	Beurre Capiaumont ...	...	5	...	...	...	5
	Princess ...	...	2	...	...	...	2
	Doyenne du Comice ...	...	3	...	...	...	3
	William's Bon Chretien ...	...	2	...	...	...	2
	Souvenir du Congress ...	...	2	...	...	...	2
	Marie-Louise d'Uccle ...	...	2	...	...	...	2
	Fertility ...	...	28	5	3	1	36
	William bon Chretien ...	...	...	...	6	...	6
	Belle Julie ...	...	...	...	4	2	6

Species of fruit trees.	Variety.	Planted, 1919-21.						Lower garden.	Total number.	Description.
		Upper garden.								
		South-west block.	Top block.	West block.	South block.	East block.				
1	2	3	4	5	6	7	8	9	10	
Pear trees	Suckle	2	...	3	5	Standard	
	Bartlett Hybrid (Starks)	1	...	...	...	4	...	5
	Fame ( " )	...	...	...	...	2	2	4
	Rehl Best ( " )	...	...	...	...	4	1	5
	Boussock ( " )	...	...	...	...	3	1	4
	Triumph (")	3	...	...	...	3	...	6
	Winter Bartlett ( " )	...	...	...	...	3	4	7
	Comice ( " )	...	...	...	...	2	1	3
	Total	4	...	88	25	68	19	204	Upright trained	
	Princess	...	...	4	...	...	...	4
	Conference	...	...	...	...	...	3	3
	Madame Treve	...	...	...	5	...	...	5
	Marie Louise d' Ucele	...	...	...	...	...	3	3
	Louise Bonne of Jersey	...	...	...	...	...	4	4
Beurre Hardy	...	5	...	...	...	...	5	
Fondante d' Automne	...	...	...	...	...	4	4	
Winter Nellis	...	...	...	...	...	4	4	
Conseiller de la Cour...	...	...	...	...	...	3	3	
Doyenne du Comice	...	...	...	...	...	3	3	
Marguerite Marillat...	...	6	1	...	...	...	5	
Total	...	9	5	5	...	24	43			

No. of fruit trees.	Variety.	Planted, 1913-21.							Total number.	Description.
		Upper garden.								
		Top block.	South block.	East block.	North block.	Lower garden.	South-west block.			
1	2	3	4	5	6	7	8	9	10	
	Late Transparent	6	...	8	Bush.	
	Guthrees Late Gage ...	...	4	...	...	...	...	4
	Deniston's Superb Gage.	...	3	...	...	7	...	10
	White Botan ...	...	2	...	...	...	2	4
	Satsuna ...	...	1	...	...	1	3	5
	Nurbank ...	...	2	...	...	...	1	3
	Prosperity ...	...	6	...	...	...	...	6
	Reine Claude de Bavay	...	3	...	...	...	...	3
	Belle de Louvain	...	...	...	...	5	...	5
	Curlew ...	...	5	...	...	...	...	5
	Utility ...	...	2	...	...	...	1	3
	Greengage ...	...	...	...	...	1	4	5
	Coxs Emperor ...	...	4	...	...	...	...	4
	Heron ...	...	5	...	...	...	...	5
	Mitchelsons ...	...	7	...	...	...	...	7
	Monarch ...	...	...	3	...	...	3	6
	Ickworth ...	...	2	...	...	...	...	2
	Stark's Gold ...	3	...	...	...	...	...	3
	Diamond ...	...	3	...	...	...	...	3
	Belgian Purple ...	...	1	...	...	6	...	7
	Bitters ...	...	5	...	...	...	...	5
	Burford Plumcot ...	1	...	...	...	...	...	1
	Primate ...	...	4	...	...	...	...	4
	Pond's Seedling ...	...	7	...	...	3	1	11
	Admiral ...	...	5	...	...	...	...	5
	Stark's Shiro ...	1	...	...	...	1	...	2
	President...	...	6	...	...	...	...	6
	Stark's Omaha ...	...	1	...	...	1	...	2
	Jefferson ...	...	3	...	...	...	...	3
	Autumn Beauty ...	...	1	...	...	...	...	1
	Wyedale ...	...	3	...	...	...	...	3
	King of the Damsons	...	...	...	...	2	...	2
	Kirks Blue ...	...	3	...	...	...	...	3

Species of fruit trees.	Variety.	Planted, 1913-21.						Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	Lower garden.	South-west block.			
1	2	3	4	5	6	7	8	9	10	
Plum trees	Shepherd's Bullace ...	...	...	...	...	8	...	8	Bush.
	Czar ...	...	...	5	...	...	...	5	
	Langley's Bullace ...	...	...	...	...	3	...	3	
	Victoria ...	...	...	6	...	...	...	6	
	White Damson ...	...	...	...	...	3	...	3	
	Prince Englebert ...	...	...	3	...	...	...	3	
	Prune Shropshire ...	...	...	...	...	3	...	3	
	Kashmir Greengage...	...	...	3	...	...	...	3	
	Merryweather Damson ...	...	...	...	...	9	...	9	
	Count d' Althaus gage ...	...	...	1	...	...	...	1	
	Stint ...	...	...	1	...	...	...	1	
	Burbanks Giant Prune ...	...	...	8	...	3	...	11	
	Total ...	...	8	111	5	...	57	16	193
	Decaisne	1	...	1	Fan trained.
	Kirkes ...	...	...	...	...	...	2	...	2
	Jefferson ...	...	...	...	...	...	2	...	2
	Mallard ...	...	...	...	...	...	1	...	1
	Golden Esperen ...	...	...	...	...	...	1	...	1
	Oullin's Golden Gage ...	...	...	...	...	...	1	...	1
	Reine Claude d' Althaus ...	...	...	...	...	...	1	...	1
	Early Transparent ...	...	...	...	...	...	1	...	1
	Coe's Golden Drop ...	...	...	...	...	...	1	...	1
	Transparent Gage ...	...	...	...	...	...	1	...	1
	Greengage ...	...	...	...	...	...	1	...	1
	Belgian Purple ...	...	...	...	...	...	1	...	1
	Total ...	...	...	...	...	...	14	...	14

Species of fruit trees.	Variety.	Planted, 1913-21.							Description.
		Upper garden.				Lower garden.	South-west block.	Total number.	
		Top block.	South block.	West block.	North block.				
1	2	3	4	5	6	7	8	9	10
Cherry trees ...	Morello	18	3	21	Trees.
	Kentish ...	...	8	...	...	7	...	15
	White Heart ...	...	...	...	...	2	...	2
	Black Heart ...	...	...	...	...	2	...	2
	Kashmir (French varieties).	...	20	...	...	1	...	21
	Montmorency King ...	...	2	...	...	...	...	2
	Burbank ...	...	4	...	...	1	...	5
	Total	...	52	3	...	13	...	68	
	Turkey Black Heart...	1	...	1	Fan trained.
	Late Black Bigarreau	...	...	...	...	1	...	1
	Frogmore Bigarreau	...	...	...	...	1	...	1
	Noir de Guben	...	...	...	...	1	...	1
Belle de St. Troaz	...	...	...	...	1	...	1	
Total	...	...	...	...	5	...	5	
Orange trees ...	Japanese Satsuma	2	2	Trees.
	Japanese Kumquat ...	...	7	...	...	3	...	10
	Malta Blood ...	...	13	...	...	1	...	14
	St. Michael's ...	...	13	...	...	1	...	14
	Jaffa ...	...	2	...	...	1	...	3
	Malta Oval ...	...	1	...	...	1	...	2
	Silver ...	...	4	...	...	...	...	4
	Excelsior ...	...	1	...	...	1	...	2
	St. Michael's Tangierin.	...	2	...	...	3	...	5
	St. Michael's Dom Louise.	...	1	...	...	2	...	3
	St. Michael's Sustain	...	1	...	...	1	...	2
	Ditto Achilles	...	...	...	...	1	...	1
Total	...	47	...	...	15	...	62	

Species of fruit trees.	Variety.	Planted, 1913-21.							Description.
		Upper garden.				Lower garden.	Southwest block.	Total number.	
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Lime and Lemon trees.	Karla Lime	1	2	3	}
	Imperial Lemon ...	...	...	...	...	2	...	2
	Gora Lime ...	...	2	1	...	...	...	3
	Bijou Lemon ...	...	...	...	...	4	...	4
	Kagzi Lime ...	...	2	...	...	...	...	2
	Total	5	3	...	6	...	14	
Walnut trees ...	Dwarf Prolific	7	10	...	17	}
	Kashmir ...	...	7	2	...	1	...	10
	Total ...	...	14	2	...	11	...	27
Peach trees ...	Princess of Wales	3	3	}
	Peregrine ...	...	...	...	...	13	...	13
	Alexander ...	...	...	...	...	13	...	13
	Duke of York ...	...	...	...	...	17	...	17
	Exquisite ...	...	...	...	...	2	...	2
	Late Devonian ...	...	...	...	...	1	...	1
	Lady Palmerston ...	...	...	...	...	2	...	2
	Kestrel ...	...	...	...	...	5	1	6
	Hales Early ...	...	...	...	...	...	3	3
	Total ...	...	...	...	3	54	4	61
Apricot trees ...	Superb (Starke)	1	...	1	}
	Elmhurst ...	...	...	...	...	5	...	5
	Kashmir ...	...	7	...	...	...	...	7
	Total ...	...	7	...	...	6	...	13

Species of fruit trees.	Variety.	Planted, 1913-21.						Total number.	Description.
		Upper garden.				Lower garden.	South-west block.		
		Top block.	South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9	10
Quince trees ...	Meeks Prolific	...	...	1	...	...	1	...	2
	Champion	...	...	1	...	...	...	...	1
	Portugal	...	...	1	...	...	1	...	2
	Total	...	...	3	...	...	2	...	5
Almond trees ...	Hill Almond	...	...	12	...	...	...	...	12
	Total	...	...	12	...	...	...	...	12

Trees.

Species of fruit trees.	Variety.	Planted, 1918-20.					Total number.	Description.
		Upper garden.			Lower garden.	South-west block.		
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Wineberry	3	3	...	3	Berries.
King's Acro Berry	.....	...	...	...	...	5	5
Loganberry	.....	...	...	...	...	3	3
Phenomenal	.....	...	...	...	...	3	3
Laxtonberry	.....	...	...	...	...	3	3
Blackberry	Blowers	...	...	...	100	...	100
Ditto	Pyne's Giant Himalaya Berry of California.	100	...	100	Plants.
	Total	...	...	...	203	14	217
Strawberry	Givon's late Prolific...	...	...	...	...	200	200
	Royal Sovereign	1,000	...	...	...	3,000	4,000
	Total	1,000	...	...	...	3,200	4,200
Currant	Bookeop Giant Black...	...	3	3	Bushes.
	Blacksmith	4	...	...	...	...	4
	Defender Black	...	1	...	...	...	1
	Victoria Black	6	...	...	...	...	6
	Southwell's Black	...	6	...	...	...	6
	White La Vermelle	4	...	...	...	...	4
	Total	13	9	22	Trees
Nut trees	White Filbert	...	...	...	2	...	3
	Red Filbert	...	...	...	3	...	3
	Prize Cob	...	...	...	3	...	3
	Kentish Cob	...	...	...	3	...	3
	Total	...	...	...	11	...	11

Species of fruit trees.	Variety.	Planted, 1913-21.					Total number.	Description.
		Upper garden.			Lower garden.	South-west block.		
		South block.	East block.	North block.				
1	2	3	4	5	6	7	8	9
Grape Vines	Campbell's Early (Starks).	...	2	2	} Vines.
	Hicks (Starks)	...	3	...	...	...	3
	King (")	...	2	...	...	...	2
	Eclipse (")	...	1	...	...	...	1
	King Philip (")	...	2	...	...	...	2
	Wilder (")	...	2	...	...	...	2
	Worden (")	...	2	...	...	...	2
	Niagara (")	...	2	...	...	...	2
	Total	...	16	16	

Summary of Fruit Trees planted to 31st March 1921.

							Total.
1							2
Bush	Apple trees	...	...	...	...	...	2,851
Standard	" "	...	...	...	...	...	945
Horizontal	trained Apple trees	...	...	...	...	...	60
Upright	" " "	...	...	...	...	...	34
Palmette Verrier	" " "	...	...	...	...	...	29
Fan	" " "	...	...	...	...	...	5
Double Cordon	" " "	...	...	...	...	...	3
Single	" " " "	...	...	...	...	...	3
Bush and Pyramid Pear	"	...	...	...	...	...	485
Single Cordon	" "	...	...	...	...	...	150
Horizontal trained	" "	...	...	...	...	...	42
Standard	" "	...	...	...	...	...	204
Upright trained	" "	...	...	...	...	...	48
Bush Plum trees	...	...	...	...	...	...	163
Fan trained Plum trees	...	...	...	...	...	...	14
Cherry standard trees	...	...	...	...	...	...	63
Cherry fan trained trees	...	...	...	...	...	...	5
Orange trees	...	...	...	...	...	...	62
Lemon	"	...	...	...	...	...	14
Walnut	"	...	...	...	...	...	27
Peach	"	...	...	...	...	...	61
Apricot	"	...	...	...	...	...	13
Quince	"	...	...	...	...	...	5
Almond	"	...	...	...	...	...	12
Wineberry	...	...	...	...	...	...	3
King's Acre berry	...	...	...	...	...	...	5

							Total.
1							2
Loganberry	...	...	...	...	...	...	8
Phenomenal Berry	...	...	...	...	...	...	3
Laxtonberry	...	...	...	...	...	...	3
Blower's Blackberry	...	...	...	...	...	...	100
Giant Himalaya Blackberry	...	...	...	...	...	...	100
Strawberry plants	...	...	...	...	...	...	4,200
Currant Bushes	...	...	...	...	...	...	23
Nut	...	...	...	...	...	...	11
Grape Vines	...	...	...	...	...	...	16

C. H. HOLDER,

*The 15th May 1921.**In charge, Fruit Experiment
Station, Shillong*

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st April 1920 to 31st March 1921.

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale-proceeds of Apples ...	680 8 0	Allowance to Superintendent	3,000 0 0
" of Pears ...	10 0 0	Establishment ...	2,550 0 0
" of Peaches ...	10 0 0	Petty construction ...	97 9 2
" of Strawberries.	77 12 0	Instruments, Appliances, Apparatus and Machinery.	192 3 0
" of Plums ...	10 0 0	Wages of labourers ...	4,285 0 0
" of Stones ...	4 6 0	Seeds, Plants and Manures	699 0 8
		Service postage ...	20 0 0
		Other charges ...	809 9 9
Total Receipts ...	792 9 0	Total Expenditure ...	11,743 6 2

REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING THE 31st MARCH 1921.

1. This station was established in January 1914. It is situated on the Sylhet-Silchar road, $3\frac{1}{2}$ miles to the west of the Subdivisional Station of Karimganj, which lies on the Assam-Bengal Railway. The total area of the Farm is a little under 80 acres. Leaving out a compact block of 8 acres set apart for the Farm-steading and quarters for the staff, and the area covered by roads, drains and *aïls* estimated at 12 acres, the net area available for cultivation is about 60 acres.

2. The Farm lies close to the Langai river which occasionally rises in high flood and lays the country all round under water. This liability to floods is characteristic of rice lands in the locality.

The soil of the greater portion of the Farm is a deep alluvial lay of fine texture, though not particularly heavy. In the higher portions, it is somewhat lighter in character and may be described as a medium loam.

The Farm is primarily a rice farm and out of 60 acres of arable area 55 acres are fit for paddy only. On the remaining portion rice and *rabi* crops can be grown only under favourable conditions.

Out of these, one acre has been raised and made fit for *rabi* crops.

The soil was analysed last year by the Agricultural Chemist and the results are shown below with his remarks :—

	Laboratory No. 104, Blocks B and F surface soil per cent.	Laboratory No. 105, Block C surface soil per cent.
1	2	3
A. Soluble in 26 per cent. Hydrochloric Acid with 48 hours' digestion at 100°.	.....	0.069
Phosphoric Acid (P_2O_5)	0.082	.....
Potash (K_2O)	0.743	0.897
Lime (CaO)	0.243	0.412
Magnesia (MgO)	0.806	0.928

	Laboratory No. 194, Block B and F sur- face soil per cent.	Laboratory No. 195, Block C surface soil per cent.
1	2	3
B. Available, i.e., soluble in 1 per cent. citric acid with 7 days' digestion (Dyers' Method), Phos- phoric Acid (P_2O_5).	0.006	0.008
Potash (K_2O)	0.004	0.005
C. Moisture in air-dry soil	1.68	2.00
Loss on ignition (organic matter and combined water).	3.69	4.76
Nitrogen	0.089	0.121
Calcium Carbonate	Trace	Trace
Reaction	Acid	Acid

N. B.—Percentages are expressed on air-dry materials.

"A (a) Lime is deficient and the ratio of magnesia to lime is high; this is probably not of so great importance from the point of view of paddy cultivation as it would be in the case of many other crops. Experiments on small dressing of 5 or even 10 maunds lime per acre might perhaps give results in combination with green-manuring and the use of phosphate.

(b) Both total and available phosphate are on the low side; experiments using basic slag, superphosphate and bone dust on a basis of a given quantity of phosphoric acid per acre might be tried.

(c) Total potash is very high and available supplies would appear to be on the border land. Small dressings of potash may show results in the case of paddy.

(d) Nitrogen is quite fair in sample number 195 and average in 194. I am of opinion, however, judging by the soil's behaviour in the laboratory, that nitrogen is not in a very available condition and a good response might follow moderate nitrogen dressings.

(e) An increase in the humus content would seem desirable. Green-manuring and the regular use of cow-dung as manure would help matters. For paddy, however, I would not advise excessive dressing of cow-dung."

The experiments already in progress on the farm are very much on the lines suggested by the chemist.

3. The godown started last year was completed in June. It

Reclamation, con- is proving very useful for storing paddy seed
struction and repairs. for experiments.

A new pucca cattle-shed was built during the year which will accommodate 15 pairs of bullocks. The apprentices' quarters have also been thoroughly repaired. A second apprentices' quarters are now urgently required if Agricultural Demonstrators are to be trained as fast as they are wanted for demonstration work. The Farm Manager's quarters as well as the office need thorough repair. Enough bricks have been burnt to replace the *ikra* walls of these buildings with brick walls.

4. One bullock died of old age during the year. Seven bullocks were purchased and two bullocks sent to the Upper Shillong Farm in 1918 were returned. There are now 29 bullocks in the Farm. On the whole their condition is good.

5. On the whole the season was favourable for paddy which is the main crop of the farm. The early rains in March and April were not favourable to jute. Heavy showers in October prevented the early sowing of *rabi* crops. On the other hand, there was hardly enough rain during the growing season for a full crop. The actual and normal rainfall are given below :—

—					Actual.	Number of rainy days.	Normal rainfall.
1					2	3	4
April	1920	...	...	...	12.4	17	14.58
May	"	...	...	...	21.11	14	23.20
June	"	...	...	...	22.56	23	22.93
July	"	...	...	...	13.18	21	26.92
August	"	...	...	...	27.38	24	21.46
September	"	...	...	...	16.96	14	18.04
October	"	...	...	...	7.16	8	8.36
November	"	...	...	...	1.0	1	1.35
December	"	...	...	...	0.3	Nil	1.16
January	1921	...	...	...	8.3	2	2.6
February	"	...	...	...	6.9	2	2.42
March	"	...	...	...	8.34	7	7.88
Total					130.74	140	148.56

Though the actual rainfall in July was below the normal, it was well distributed throughout the month.

6. As befits a station situated in such an extensive rice-growing district, attention is devoted mainly to effect improvements in this staple.

Rice-breeding.

Rice-breeding experiments were arranged in 1914, after a consultation between Mr. A. G. Birt, Deputy Director of Agriculture, Mr. G. P. Hector, Economic Botanist to the Government of Bengal, and Rai Bahadur B. C. Basu, Special Officer for Agriculture. These experiments have been carried on since with slight additions and alterations.

An account of the methods adopted, together with various modifications which circumstances have since rendered necessary, have been described in detail in the previous report. They may be briefly described as follows:—

Exhaustive collections of local varieties are made from all parts of the Province and grown on the farm on small plots. Pure types are isolated from these; very often the so-called varieties split into two, three, or sometimes even into a larger number of types. These are grown in small plots side by side for two or three years for comparison. The types which appear to be distinctly inferior or unsuitable are discarded after the preliminary trial; the remaining types are retained as worthy of further trials. With the object of finally selecting one or two of the heaviest yielding types of each class, a few, which show specially good qualities in single plots, are selected and tested against one good type taken as the standard, each of the other types being grown twenty-five times alongside the standard type. Small plots are of necessity used, each consisting of fourteen lines of fourteen plants or 196 plants, in all. By repeating the tests in this way accidental differences due to soil or water level is eliminated. The average of the yields thus obtained should be a reliable indication of the cropping powers of each type tested. The types which come out best are recommended to cultivators. At the same time new varieties are sent by the Agricultural Inspectors every year and added to the list of types kept under observation. Up till 1919, the work was restricted to early broadcast rice and transplanted winter *Sail* rice, the latter forming the most important class of rice grown in the Valley. During the year under report a beginning has been made with transplanted *Aus* and shallow *Aman*, which occupy considerable areas in the Surma Valley. A large collection of these was grown at the farm and a large number of types separated. These will be sown separately and selection work will be continued on the same principle as with *Sail* paddy.

A large number of *Aman* and *Boro* varieties have been collected and will be grown in the farm mainly with the object of isolating pure types for comparison.

Fifty-nine types of early broadcast *Aus* are now being dealt with, and from a comparison of their cropping and other qualities they have now been divided into two sub-classes. One lot contains ten types and belongs to the *Dumai* sub-class, which is one of the quickest maturing classes of rice known. The other lot belongs to the *Murali* sub-class. Three types were selected from the first lot and six from the second lot and are being tested according to the above method. The tests with *Dumai* will be continued for another year before the results are published. The results of the tests with *Murali* paddy are shown below :—

MURALI STANDARD M $\frac{36}{30}$.

Name of varieties.	Average yield in tolas per 100 plants.	Average number of tillers per plant.
1	2	3
$\frac{36}{11}$	27.281	2.75
$\frac{36}{33}$	30.677	2.75
$\frac{36}{12}$	26.38	2.43
$\frac{36}{30}$	27.825	2.66
$\frac{36}{14}$	25.169	2.76
$\frac{36}{30}$	25.946	2.53
$\frac{36}{20}$	23.833	3.15
$\frac{36}{30}$	25.760	2.60
$\frac{36}{32}$	24.160	2.55
$\frac{36}{30}$	24.575	2.56
Kataktara	22.530	1.96
$\frac{36}{30}$	24.760	2.64

From the above, $\frac{36}{30}$ would appear to be the best although $\frac{36}{34}$ came nearly equal. Small quantities of $\frac{36}{30}$ were tried on a few cultivator's plots round about the farm and showed their over superiority everywhere. Eighteen maunds of this seed have been sent out for demonstration in the district during the coming season. The two types $\frac{11}{11}$, $\frac{36}{12}$ have been rejected and $\frac{26}{4}$ have been added and the series tests will be conducted with these during the coming year with $\frac{36}{30}$ as standard.

Transplanted Aus.—During the last year ninety-six types have been isolated from thirty-five collections. These will be grown in single plots and selection will be continued until pure lines are established.

Asra.—Similar work is being carried on with *Asra*. Ten varieties, which have so long been grown with *Asra*, are now being grown separately. Thirty-nine types have been isolated from twenty-nine varieties collected through Agricultural Inspectors last year.

Sail.—Work with *sail* varieties has been going on continuously since 1917. New varieties are being added and unsuitable ones are being discarded every year. The total varieties under trial now number, 193 of which 63 are new selections.

In 1918, on the recommendation of the Economic Botanist, Bengal, four of what appeared to be the best types, were selected for a thorough test against *Indrasail*. Three were subsequently added. The results of the last two years are given below :—

Name of varieties.				Average yield in tolas per 100 plants.	
				1919.	1920.
1				2	3
Indrasail	...	...	...	133.57	160.745
Latisail	...	...	...	128.303	172.495
Indrasail	...	...	...	137.02	153.75
Georgesail	...	...	...	133.755	169.19
Indrasail	...	...	...	137.26	168.005
Dhalmegh	...	...	...	122.000	159.07

Name of varieties.	Average yield in tolas per 100 plants.	
	1919.	1920.
1	2	3
Indrasail	129.78	166.217
Soiamara	108.374	129.49
Indrasail ... ..	...	174.56
Nagra ... ..	...	172.168
Indrasail ... ..	...	172.86
Proshadbhog ... ..	...	150.329
Indrasail ... ..	...	169.3
Balam ... ..	...	161.23

In order to test the selected rice on a large scale, before recommending them to the cultivators they were grown on a large number of plots of $\frac{1}{10}$ acre each. The results are given below :—

	Average yield per acre in pound.			
	1918.	1919.	1920.	Average.
1	2	3	4	5
Indra sail	2,732	2,361	3,359	2,800
Latisail	2,482	2,246	3,161	2,629
George sail	2,359	2,052	3,343	2,585

The tests for the last three years show conclusively that *Indra-sail*, *Georgesail*, and *Latisail* have proved themselves definitely superior to other varieties. The results have been confirmed by a large number of demonstrations carried out throughout the Valley during the last two seasons. *Latisail* was given to the cultivators during the last year for the first time and has proved very popular on comparatively high lands. The results outside would indicate that the above three varieties are suited to lands of different levels. Experiments are being conducted in the farm to find out the level, best suited for each type.

In order to compare the three selected varieties against a local variety under strictly comparable conditions they are being grown against a good local variety on the farm in two-halves of $\frac{1}{10}$ acre plots repeated five times.

Arrangements have been made for distributing the above three varieties on a large scale throughout the Valley. Two hundred and twelve maunds of these three varieties were sold and distributed from the Farm in 1920 of which 121 maunds were sent to the Assam Valley. It is no longer necessary to carry out the tests on the small plots with *Indrasail*, *Georgesail* and *Latisail* as they have definitely established their superiority. *Siamra* and *Dhalmegh* will be discarded as they have proved definitely inferior. Three new varieties were added in this series last year and two more are being added during the coming year. The tests will now be continued with these five, with *Latisail* as the standard.

7. The following minor experiments were carried out on a small scale :—

- (1) Bonemeal as a manure for double cropped land.
- (2) Green-manuring with *dhaincha* for *sail* paddy alone and in conjunction with bonemeal.
- (3) Trial of late transplanted rice.

(1) *Bonemeal as a manure for double cropped land.*—The experiment was started in 1915. The first crop of 1915 and the second crop of 1915 were injured by floods and no crops were obtained. The results of the last six years are shown below :—

	Yield per acre in pound.						Average annual crop.
	1915	1916	1917	1918	1919	1920	
	2nd crop.	1st crop.	Two crops.	Two crops.	Two crops.	Two crops.	
1.	2	3	4	5	6	7	8
Bonemeal at 247 lbs. per acre in alternate years.	3,336	1,537	4,434	2,612	1,531	5,364	3,128
No manure	2,738	1,435	4,164	2,360	1,317	4,322	2,904
Bonemeal at 494 lbs. per acre in alternate years.	2,962	1,570	4,277	2,142	412	5,213	2,930
No manure	3,013	1,536	4,066	2,250	1,392	4,791	2,641
Bonemeal at 247 lbs. per acre yearly.	2,962	1,695	3,812	2,250	1,153	4,665	2,764
No manure	3,065	1,475	3,353	2,451	1,160	4,610	2,655

The results are fluctuating. But an application of 247 lbs. (3 maunds) per acre every alternate year has consistently given better results than the unmanured plots or other applications. During the last four years (during which two annual crops were obtained) a total quantity of 1,290 pounds valued approximately at Rs. 40 (at Rs. 2-8, per maund) was obtained by the application of 49½ pounds or 6 maunds of bonemeal in 2 doses. At present prices (Rs. 4-8 per maund) this would leave very little margin—although it would pay all expenses. But when the price of bonemeal goes down to the normal level an application of 3 maunds per acre, once in three years, would be found quite economical in poor soils. It is hardly likely to be economical on land which receive any silt from inundation.

(2) *Green-manuring*.—The use of green-manuring as reported in last year's report has always given very satisfactory results as shown below :—

<i>Dhaincha</i> alone.	<i>Dhaincha</i> and bonemeal at 247 lbs. per acre.	No manure.
lbs.	lbs.	lbs.
2,295	2,504	2,383

During the year under report the *dhaincha* could not be sown in time on account of early rains and hardly grew at all. The experiment will be repeated.

(3) *Trial of late transplanted rice*.—Owing to the risk of damage by flood occurring at any time of the paddy growing season, it is advisable to have a few varieties with as great a range of growing period as possible. With this object *Jaria* from Sylhet and *Gandhi sail* from Bengal have been grown during the last 4 years. These varieties bear transplanting later in the season than other *sail* varieties. The results are given below :—

		<i>Gandhi sail</i> .	<i>Jaria</i> .
		lbs.	lbs.
1918	...	1,630	1,914
1920	...	1,204	933

In 1918 they were planted late in September and 1920 early in October.

The yields are comparatively poor, but these varieties are useful only as a last resource when all chances of getting a normal crop have failed.

8. The experiment with jute consists of a combined variety and manurial experiments. The local variety known as Dhaleswari was tested against the Kakaya Bombai which is a pure line selected by the Fibre

Expert, Bengal, at Dacca. The average outturn of fibre in pounds per acre for the past six years was as follows :—

				Yield per acre in pounds.	
				Kakaya Bombai.	Local Dhaleswari.
1				2	3
1915	...	...	...	2,036	1,224
1916	...	...	...	1,734	1,115
1917	...	...	...	1,441	1,301
1918	...	...	...	1,625	1,193
1919	...	...	...	2,767	2,583
1920	...	...	...	619	445
Average	...	...	...	1,703	1,302

During the first three years the local variety used was *Basnali*. Since 1918, *Dhaleswari*, which is said to be a superior local variety, is being used. In all cases the superiority of K.B. jute has been invariably and definitely established. The manurial experiments started in 1919 were discontinued, as the plots were found to be very uneven, but the residual effects during the year under report were recorded, and the effect of water hyacinth ash at 12 maunds per acre was tried on a new plot.

The results are given below :—

Manure per acre.	1918.	1919.	1920.	Average annual crop.
1	2	3	4	5
Cowdung	707	2,813	666	1,305
Bonemeal at 247 pounds ...	1,152	2,200	747	1,378
Bonemeal at 247 pounds and Water Hyacinth ash at 494 pounds ...	1,683	2,940	882	1,355
Bonemeal at 247 pounds Water Hyacinth ash at 494 pounds and limestone at 833 pounds ...	...	3,098	886	1,992
Additional dose of cowdung at 150 maunds or 5½ tons ...	...	2,932	1,173	2,053
Hyacinth ash at 988 pounds ...	...	...	1,063	1,063

The results do not lead to any definite conclusions except to indicate that water hyacinth ash is likely to prove a very suitable manure. A series of experiments have been laid down in new plots with a view to test the efficacy of bonemeal, water hyacinth ash and fish manure singly.

Double cropping with jute and paddy.—It is occasionally objected that the spread of jute growing is likely to reduce the area available for paddy. This is of course true with *aus* and *aman* paddy. But to test whether jute and *sail* paddy cannot be profitably grown in succession on the same land an experiment was started on a small scale in 1918, and repeated last year.

The results are given below :—

—	Jute in pounds per acre.	Paddy in pounds per acre.	Actual money receipt per acre.
1	2	3	4
1918 	984	1,774	Rs. a. p. 133 12 0
1920 	534	1,796	97 15 0

There is a large trade in extracting fish oil in Sunamganj and other parts of Sylhet district. The refuse is thrown away. The manurial resources of the Valley can be considerably developed if this can be utilised. With this object a quantity of the refuse has been collected and its effect will be tested both on paddy and jute.

9. Small plots of the following six varieties were grown on the Farm with the principal object of teaching the apprentices the method of sugarcane cultivation and also for supplying sets :—
Improved Sugarcane Varieties. B147, B376, Striped Mauritius, Dacca Gandary, Local Bcm bai and Kejo. The area under all the above varieties was 2 acre, and 9,726 cuttings and 513 pounds of *gur* were obtained. The old plot will be kept as ratoon and a new plot put under the above varieties.

10. *Pulses.*—Experiments are being conducted during the last two years to test the possibilities of growing pulses in the Farm. But the results so far are not encouraging. Both in 1919 and 1920 the weather proved very unfavourable and no crop worth the name could be obtained.

Potatoes.—Small plots of the improved Shillong varieties were grown against the local variety and the results are given below :—

	Pounds per acre.	
	1919.	1920.
1	2	3
King of Potatoes	5,022	11,214
Windsor Castle	5,156	5,502
Up-to-date	2,993	6,113
Imperator	2,424	6,443
British Queen ... ..	...	7,002
Magnum Bonum ... ..	...	5,548
Local	1,415	7,023

Large tubers were tried against small tubers, and whole setts against cut setts with the following results :—

Large tubers	7,442 pounds per acre.
Small "	3,993 " " "
Whole setts	4,894 " " "
Cut "	3,132 " " "

An experiment is also being conducted to test how far the disease prevalent in Shillong occur in the plains and also whether it is propagated through seeds.

Small quantities of Pusa wheat and Patna linseed were sown and they grew well.

Oats were grown and gave a fair crop.

Tobacco.—Several varieties of tobacco were obtained from Rangpur and grew quite satisfactorily. They were partially damaged by a heavy hailstorm towards the latter part of March. The tobacco is being harvested now.

11. All the Farm lands capable of growing *soil* were cropped with *Indrasail*, *Georgesail* and *Latisail* for seed. The rest of the areas excluding the experimental plots was put under *Asra*

Non-experimental
crops.

and *Aus.* The total yield from about 55 acres was 1,631 maunds or 29 maunds 26 seers per acre. *Georgesail* gave an average of 26 maunds 24 seers, *Latisail* 29 maunds and 27 seers and *Indrasail* 30 maunds and 30 seers per acre. It should be noted, however, that *Indrasail* was planted on the best land. The whole of the *sail* paddy, after meeting farm requirements, is being sent out for seed.

The following quantities of seed have been already supplied from the Farm and a stock of 400 maunds of *sail* paddy is in hand and is being gradually sent out to different places :—

Seed paddy sent out from the c.op of 1920.			
Name of variety.	Surma Valley.	Assam Valley.	Total.
1	2	3	4
	Mds. sr. ch.	Mds. sr. ch.	Mds. sr. ch.
36 M. --- 30	16 14 4	2 0 0	18 14 4
C. P. aus	2 36 12	2 28 0	5 24 12
Katak'ara	5 25 4	5 16 0	11 1 4
138 D. --- 6	2 10 0	2 0 0	4 10 0
Indra sail	75 0 0	120 0 0	225 0 0
Georgesail	65 0 0	75 0 0	140 0 0
Latisail	42 0 0	50 0 0	92 0 0
Dhalmegh	1 0 0	.....	1 0 0
Sail badul	1 0 0	10 0 0	11 0 0
Laki	.....	10 0 0	10 0 0
Total	211 6 4	317 4 0	528 10 4

12. No serious damage was caused to the Farm crops although, as usual, different insect pests made their appearance at various times. A lantern trap was purchased last year, and the practice of bagging gave very good results. An arrangement has been made to give the apprentices a systematic training in identifying and combating the common insect pests.

13. The receipts and expenditure for the financial year are shown below :—

The actual amount credited into Treasury was comparatively small because the bulk of the Farm produce is now being used for seed. It may also be noted that a large portion of the establishment charges is spent for training apprentices and is really not spent for farm work.

Receipts—

	Rs.	a.	p.
Amount credited into Treasury ...	813	8	3
Value of seeds supplied for Demonstration (from 1st April 1920 to 31st March 1921, 617 maunds 19 seers) at Rs. 3 ...	1,952	6	9
Value of stock in hand, 400 maunds seed paddy at Rs. 3 ; Rs. 1,200-473 maunds ordinary salable paddy at Rs. 2-12-0 = Rs. 1,300-12-0 ...	2,500	12	0
Bills outstanding ...	45	7	3
	<hr/>		
	5,212	2	3
<i>Deduct</i> value of Farm produce of previous year sold during the year excluding the value of 13 maunds 33 seers of seed paddy for Farm ...	299	2	1
	<hr/>		
Nett Receipts ...	4,913	0	2

Expenditure—

Capital—

Petty construction ...	4,299	2	3
Purchase of books ...	50	0	0
Reclamation ...	159	14	3
Purchase of cattle ...	297	10	0
Purchase of machinery such as ploughshare and mathematical instruments, etc. ...	69	10	0
	<hr/>		
	4,875	10	6

Recurring—			Rs.	a.	p.
Establishment	...	...	3,972	11	3
Feed of cattle	...	...	419	13	0
Seeds, plants, manures and imple- ments	...	...	79	14	6
Wages of labourers	...	...	2,839	5	4
Petty repairs	...	...	508	4	0
Purchase of medicines	...	...	45	2	0
Purchase and repair of furniture	...	...	168	15	6
Service postage and telegram charges	...	...	57	0	6
Stationery purchased in the country...	...	...	5	9	6
Other charges	...	...	773	12	9
			8,840	8	4
Value of seeds potato supplied by the Seed Depot, Sylhet			79	2	0
Grand total			13,795	4	10

14. The pay of the lower subordinate staff was revised by the Government during the year as a part of the general scheme of the revision of the salary in all departments. The sanctioned establishment of the Farm consists of :—

			Rs.
1 Farm Manager	...	...	100—5—200.
1 Assistant Farm Manager	...	...	60—6—120.
1 Farm clerk	...	...	30— $\frac{1}{2}$ —50.
1 Peon	...	...	11— $\frac{1}{6}$ —15.

Most of the routine work of the Farm is now being carried out by the Assistant Farm Manager appointed last year and the Farm Manager can now devote more attention to experimental work. Both the Farm Manager and Assistant Farm Manager worked satisfactorily.

The health of the Farm was fairly good during the year. The Farm Manager was on privilege leave for 43 days when the Assistant Farm Manager acted for him.

15. Three apprentices completed their training during the year and were appointed as Agricultural Demonstrators. Two more completed their training on 31st March and have been appointed as Agricultural Demonstrators from 1st April. Eight apprentices were under training on 31st March, of whom three were Hindus and five Muhammadans. The system of sending out the senior apprentices to work with Agricultural Demonstrators during the last few months of their training has been found very satisfactory. There has also been considerable general improvement in their training. A Muhammadan apprentice was sent to Sabour after one year's practical training on the Farm and another is undergoing training with the same object.

The Farm was visited once by the Chief Commissioner, once by the Commissioner, and twice by the Director of Land Records and Agriculture, Assam. The Farm was also visited by Mr. G. P. Hector, Imperial Economic Botanist, to whom my grateful thanks are due for advice in the paddy selection work. The Economic Botanist of Assam has joined recently and has taken up his headquarters at Karimganj temporarily. Considerable extension of the botanical work may now be expected. The Farm was inspected constantly by me.

*Dated Karimganj, }
The 5th May 1921. }*

J. N. CHAKRAVARTY,
*Deputy Director of Agriculture, Surma Valley
and Hill Districts.*

REPORT ON AGRICULTURAL DEMONSTRATIONS IN THE ASSAM VALLEY CIRCLE FOR THE YEAR ENDING 31st MARCH 1921.

Babu Satyendra Chandra Dutta continued to act as Superintendent of Agriculture, Assam Valley, till January 1921 when he was relieved by Mr. L. Barthakur, who was officiating Deputy Director of Agriculture and reverted to his former post of Superintendent on the return from leave of Mr. A. G. Birt. Mr. Barthakur was on tour for 55 days as Superintendent of Agriculture, and visited Calcutta in connection with the supply of sugarcane mills. Babu Satyendra Chandra Dutta was on tour for 174 days while acting as Superintendent of Agriculture, visiting all the districts in his charge, and also the Karimganj Farm and Sylhet in connection with an agricultural meeting. On reversion to the post of Inspector he was in direct charge of the work in Goalpara district during the absence on leave of Inspector Srijut Lalit Mohan Das, and also exercised general supervision over the work of the Inspectors in Kamrup, Nowgong and Darrang. As Inspector he was on tour for 52 days.

Srijut Lalit Mohan Das continued in charge of demonstration work in Goalpara district. He was on tour for 140 days and on privilege leave for $2\frac{1}{2}$ months during the year. Three Demonstrators are employed under him, and are headquartered at Dhubri, Abhayapuri and Bilasipara, respectively.

Babu Pulin Behari Ghoso held charge as Agricultural Inspector, Kamrup, and was on tour for 214 days. He was on privilege leave for $1\frac{1}{2}$ months during the year. He had the assistance of three Demonstrators headquartered at Gauhati, Nalbari and Palashbari.

Srijut Mohi Chandra Gogoi was Agricultural Inspector, Nowgong, up till January when M. Karim Buksh was appointed to the post on completion of 6 months' training under the officiating Superintendent of Agriculture at Gauhati. He remained in the district for about a month after the arrival of the new Inspector, handing over charge of the work in detail before proceeding to take over his charge at Dibrugarh. Srijut Mohi Chandra Gogoi toured 216 days in Nowgong, and M. Karim Buksh 67 days as Inspector, Nowgong, and 162 days while under training in Kamrup. Three Demonstrators headquartered at

Nowgong, Samaguri and Roha were employed in the district during the year. The Roha Demonstrator was transferred there from Kamrup at the beginning of January.

Srijut L. Kakoti was appointed Agricultural Inspector, Darrang, after 6 months' training under the officiating Superintendent of Agriculture in Kamrup. He actually joined at Tezpur on 22nd January 1921, but previous to this was able to do some preliminary work in the district during his period of training. He was on tour for 58 days as Inspector, Darrang, and for 152 days while under training in Kamrup. He is assisted by one Demonstrator headquartered at Tezpur, who was appointed with effect from 22nd December 1920.

Srijut Debi Prosad Gohain continued as Inspector at Jorhat, and was on tour for 204 days. Towards the close of the year for the sake of convenience the subdivision of Sibsagar with one Demonstrator was put under the Agricultural Inspector at Dibrugarh, and the subdivision of North Lakhimpur with one Demonstrator appointed from 23rd February 1921 was taken over by the Inspector at Jorhat. The Jorhat Inspector's circle now comprises the Jorhat, Golaghat and North Lakhimpur subdivisions with a Demonstrator in each subdivisional headquarters. There is also an extra Demonstrator at Titabar.

The post of Inspector at Dibrugarh was vacant from July 1919 to February 1921 owing to Srijut Mohi Chandra Gogoi having been placed in charge of Nowgong district. On being relieved at Nowgong he was reappointed to Dibrugarh and placed in charge of the work in Dibrugarh and Sibsagar subdivisions. There are two Demonstrators in his circle, one at Tinsukia and the other at Sibsagar. He was on tour for 45 days as Agricultural Inspector, Dibrugarh, and for 213 days while in charge at Nowgong.

In the Sadiya Frontier Tract Mr. M. Smith continued in the post of Agricultural Instructor, working under the orders of the Political Officer, Sadiya. He was on tour for 64 days. Two Angami Nagas are employed under him for demonstration work in terrace cultivation.

In the Garo Hills demonstration work is carried out by a Garo Demonstrator who works under the control of the Agricultural Inspector, Goalpara.

The staff in the plains districts at the close of the year consisted of one Superintendent, seven Inspectors and sixteen Demonstrators, an increase of two Inspectors and two Demonstrators during the year. There is now an Inspector posted to each district, and one additional Inspector (Babu Satyendra

Chandra Dutta) who since the close of the year has been promoted to the second post of Superintendent in the Valley. The great need now is for more Demonstrators, of whom we require a total of at least thirty-six, *i.e.*, an average of six under each Inspector. The supply at present is limited to the number of trained apprentices we are able to turn out from the Jorhat Farm, but if the proposal for a rice Experiment Station in the Assam Valley is sanctioned, it will be possible to increase the number of apprentices under training and thus expedite the appointment of the additional Demonstrators required.

2. The work of previous years was continued and extended modifications being introduced wherever necessary. For example the necessity for actual demonstration of three roller iron sugarcane mills in many localities has disappeared, and the demonstration staff have spent a good deal of time in supplying mills on payment to cultivators. Similarly in the case of improved varieties of sugarcane, in certain tracts judging from the enormous demand for sets, little further demonstration is required, and the time of the staff has been taken up with distribution work. Then in the case of manurial demonstrations with rice, owing to the present high cost of phosphatic manures and the reluctance of the cultivator to lay out capital in this direction, we now propose to pay more attention to the introduction of improved varieties of rice and the conservation of cowdung and village refuse, etc., rather than to demonstrations with phosphatic manures.

The work will be described under the following heads:—

- (1) *Rice*—manuring and varieties.
- (2) *Sugarcane*—demonstration and distribution of varieties, three roller mills, and shallow *gur*-boiling pans.
- (3) *Jute*—demonstration and distribution of the Bengal superior variety “Kakaya Bombai”.
- (4) *Potatoes*—demonstration of Shillong and Darjeeling varieties, and distribution of Shillong “seed”.
- (5) *Miscellaneous crops*—introduction of pulses, fodder crops, etc.
- (6) *Conservation of cowdung ashes, etc.*—in covered pits.

3. The residual effect in the third year of manures applied in 1918 was observed in a few centres in Sibsagar and Kamrup. Bonemeal and Flour Phosphate was applied at the rate of 245 lbs. per acre. The cost of the manures per acre at that time was

Rice manurial demonstrations.

Rs. 9 for bonemeal and Rs. 19-8-0 for Flour Phosphate, while the actual cost of greenmanuring with *Dhaincha* to a cultivator would be about Rs. 2 per acre *plus* the value of his labour.

THIRD YEAR'S RESULTS.

(Average Yield of grain in pounds per acre.)

District.	Number of centres.	No manure check plot.	Bonemeal.	Flour Phosphate.	Bonemeal and Dhaincha (greenmanure).	Dhaincha (greenmanure).
1	2	3	4	5	6	7
SIESAGAR ...	2	1,172	1,239	...	...	...
ditto ...	1	1,086	...	1,480	...	...
Average increase in third year.	...	...	67	394	...	...
Average increase in second year.	...	...	523	858	...	...
Average increase in first year.	...	...	69	143	...	...
Total increase in three years.	...	...	659	1,395	...	...
KAMRUP ...	3	862	...	...	1,229	854
Average increase in third year.	...	...	...	...	358	86
Average increase in second year.	...	...	...	...	100	113
Average increase in first year.	...	...	...	...	218	147
Total increase in three years.	...	...	...	...	706	356

The Sibsagar results are interesting but inconclusive. Judging from the large increase shown in the second year as against the poor returns in the first year, both the phosphatic manures came into use slowly. The big decline in the third year however was to be expected, but the effect of Flour Phosphate has apparently lasted longer than that of bonemeal.

In Kamrup the difference due to greenmanuring with *Dhaincha* is within the limits of experimental error, and in the case of bonemeal *plus Dhaincha* the fact that the largest increase occurred in the third year after a very low increase in the second year is against all our previous experience.

The residual effect in the second year of manures applied in 1919 was observed in Sibasagar, Kamrup and Goalpara. The manures were applied at the same rate as in previous years, *viz.*, bonemeal and flour phosphate at 246 pounds per acre, and oilcake at 492 pounds per acre, the cost at that time being Rs. 12 per acre in each case. The average results are given below :—

SECOND YEAR'S RESULTS.
(Yield of grain in pounds per acre.)

District.	Number of centres.	No. manure check plot.	Bonemeal.	Flour phosphate.	Bonemeal and <i>Dhaincha</i> green manure.	<i>Dhaincha</i> & oilcake green manure.	Oilcake.	Remarks.
1	2	3	4	5	6	7	8	9
Sibasagar	3	1,092	1,278	...	...	...	...
Ditto	1	960	...	...	1,140	...	...
Average increase, second year ...	...	...	186	...	180	...	...
Ditto, 1st year ...	...	...	129	...	533	...	...
Total increase in two years	...	...	315	...	713	...	...
Kamrup	3	1,386	...	...	2,336	1,678	...	* <i>plus</i>
Ditto	2	2,312*	...	...	...	...	2,800*	<i>Soli.</i>
Average increase in second year...	...	...	...	...	650	282	—12	
Ditto in 1st year ...	...	...	...	...	404	317	139	
Total increase in two years	...	...	...	...	1,054	609	127	(Nett increase)
Goalpara	2	994	...	1,367	...	...	...
Ditto	2	823	1,025	...	...	...	...
Increase in 2nd year ...	...	...	197	273	...	...	...
Ditto in 1st year...	...	...	275	248	...	...	...
Total increase in two years	...	...	472	521	...	...	...

In Sibsagar the total increase for the two years due to bonemeal would only just cover the cost of the manure, but where greenmanuring with *Dhaincha* is used in conjunction with bonemeal the increase in the first year alone is sufficient to pay for the manures and leave a considerable profit. In Kamrup bonemeal *plus Dhaincha* for greenmanure gives a return of 105½ lbs. per acre as against 609 lbs. for *Dhaincha* used alone. The result of the manuring with oilcake is disappointing, but, as the no manure plots averaged over 25 maunds of *sali* paddy per acre, the land was evidently of more than average fertility, and it is possible that the oilcake had the effect of increasing the amount of straw rather than grain. In Goalpara the total increases for the two years due to bonemeal and flour phosphate both show a small profit even at the present high rates for manures.

During the year under report a number of new manurial demonstrations were laid down in all the Assam Valley Districts except Darrang which had no demonstration staff until recently. The manures were applied at the rate of 246 lbs. per acre for bonemeal and flour phosphate and 492 lbs. per acre for oilcake, as in previous years. The average results for the first year in each locality are given in the following table :—

NEW RICE MANURIAL DEMONSTRATIONS.

FIRST YEAR'S RESULTS.

(Grain in pounds per acre.)

Locality.	Number of centres.	No manure check plots.	Bonemeal.	Flour phosphate.	Bonemeal and <i>Dhaincha</i> (green manure).	<i>Dhaincha</i> (green manure).	Oilcake.	Oilcake and bonemeal.	Remarks.
1	2	3	4	5	6	7	8	9	10
Dibrugarh (subdivision) ...	3	1,462	1,006	...	...	...	...	...	Result of only one year; others considered unobtainable.
" ...	1	713	...	...	1,323	632	...	...
" ...	2	1,657	...	...	2,302	...	...	...
" ...	3	1,198	...	...	...	1,547	...	...
"	
Average increase	...	...	154	...	277	265	...	...

(Grain in pounds per acre) — contd.

Locality.	Number of centres.	N ^o manure check plots.	Bonemeal.	Flour phosphate.	Bonemeal and diastase (green manure).	Diastase (green manure).	Oilcake.	Oilcake and bonemeal.	Remarks.
1	2	3	4	5	6	7	8	9	10
Bhagar (subdivision)	4	1,230	1,742	...	...	...	...	...
	2	1,580	...	1,597	...	...	...	...
Average increase	...	...	495	307 34	...	...	...	...
Jorhat and Golaghat (subdivisions)	2	1,454	1,631	...	...	...	...	...
	2	688	...	1,608	...	...	...	...
	1	1,531	1,912	...	1,821	1,639	...	...
" ...	1	1,456	1,630	...	...	...	600	1,698	
" ...	1	1,284	1,306	1,429	...	...	1,467	1,512	
Average increase	...	...	221	142	290	108	115	221	
Nuwang	2	1,666	1,939	...	...	...	...	...
" ...	2	1,405	...	1,683	...	...	...	...
" ...	2	1,429	...	...	1,985	...	...	...
" ...	2	1,209	...	...	...	1,446	...	...
" ...	1	1,503	...	1,346	1,858	...	...	...	Bonemeal result rejected.
Average increase	...	...	573	266	425	237	...	...
Kamrup	2	1,400	1,317	...	1,848	...	...	...	Result of only one given.
" ...	1	1,810	...	...	1,946	1,900	...	...	Aw.
" ...	4	1,031	...	...	...	...	1,873	...	Aw.
" ...	1	1,246	...	...	...	...	1,822	...	Sol.
Average increase	...	47	...	...	292	90	505	...	

(Grain in pounds per acre)—concd.

Locality.	Number of centres.	No manure check plots.	Bonemeal.	Flour phosphate.	Bonemeal and daincha (green manure).	Daincha (green manure).	Oilcake.	Oilcake and bonemeal.	Remarks.
1	2	3	4	5	6	7	8	9	10
Goalpara ...	4	1,273	1,553	...	...	...	...	...
" ...	3	1,105	...	...	663	...	...	...
" ...	4	1,223	...	...	...	1,507	...	...
" ...	3	1,301	...	1,661	...	...	...	...
" ...	2	1,159	...	...	...	...	...	1,535	
Average increase...	...	...	295	360	467	279	...	378	

Except in Sibsagar subdivision, where bonemeal gave an average increase of nearly 500 pounds of paddy per acre the phosphatic manures have not given a sufficient return (at present prices) to cover the cost of their application. As however their effect is usually spread over three years this apparent loss should be turned into a substantial gain in the next two years. In Dibrugarh subdivision, Nowgong and Goalpara where bonemeal has been used in conjunction with *daincha* for greenmanure the results are better, the decaying greenmanure crop probably helping to bring the bonemeal into a more available condition Oilcake is disappointing except in Kamrup where it has given an average increase of over 500 pounds of paddy per acre.

With regard to rice manurial demonstrations generally in this Valley the experience gained up to date varies enormously according to the locality and conditions under which the demonstrations are carried out. On poor and exhausted land phosphatic manures will give a return spread over three years, but very little demand has been created amongst the cultivators for these manures. Greenmanure and oilcake give a more immediate return, and the former is inexpensive, but it is difficult to persuade a cultivator to sow a crop which has to be ploughed in for the sake of the succeeding crop, and protect it against roving herds of cattle and goats. Under the circumstances probably the most useful work in the near future will be to induce the cultivator to conserve the natural manurial resources round about the homestead, *viz.*, cowdung, ashes and household refuse, waste vegetable matter, etc., and apply them to his land regularly. In addition to this, green manuring and the sowing of

a pulse crop (*e.g.*, *Khesari*) on rice land should be encouraged wherever conditions are suitable. Phosphates will no doubt find their place as manures for rice sooner or later, but for the present it would appear that their comparative high cost and the cultivators' lack of capital will prevent any development in this direction.

4. The demonstration and distribution of Mr. Hector's *Indra Sali* and Rai Sahib Narayan Chandra Barua's *George Sali* were continued during the year in all districts with the exception of Darrang. The results of the demonstrations are given below :—

RICE—VARIETY DEMONSTRATIONS.

(Grain in pounds per acre.)

District.	Number of centres.	Local variety.	Indra Sali.	George Sali.	Increase.	Remarks.
1	2	3	4	5	6	7
Goalpara ...	7	1,521	1,903	...	382	
Ditto ...	5	1,515	...	1,614	99	Negative result at two centres.
Kamrup ...	13	1,693	2,097	...	404	
Ditto ...	5	2,078	...	2,115	37	Negative result at two centres.
Nowgong ...	14	1,894	2,169	...	215	Negative result. at three centres.
Ditto ...	8	1,897	...	2,036	139	Negative result at two centres.

In addition to the above, *Nagra Sali* gave an increase of 242 lbs. per acre in one centre in Goalpara, and 214 lbs. per acre in one centre in Nowgong.

Results of the demonstrations carried out in Sibsagar district and Dibrugarh subdivision were extremely erratic and disappointing, and have therefore not been included in the above table. In Sibsagar district *Indra Sali* gave negative result in 4 centres out of 7 and only a very small increase in the remaining 3 centres. This variety is reported to be unpopular with the cultivators in this locality owing it is said to the liability of the grain to get broken in the "dhenki."

The poor results obtained this year are probably due to sufficient care not having been taken in the selection of the land. A good deal of paddy land in this district is comparatively high and carries very little water in the rains. Such conditions are not suited to *Indra Sali*, which does best in about 9 to 12 inches of water. *George Sali* is apparently more suited to local conditions and is said to be popular with the cultivators, but it also gave negative result in 3 centres out of 6, and in the remaining 3 centres showed only a slight advantage. *Nagra Sali* gave an increase of 69 lbs. per acre in one centre and is said to be appreciated by the local people.

In Dibrugarh subdivision *Indra Sali* gave negative results in 3 out of 5 centres, but showed an increase of 272 lbs. in one centre. *George Sali* demonstrated in 2 centres gave an increase over the local variety of 518 lbs. per acre in one centre but only 46 lbs. per acre in the other centre.

In Kamrup, Goalpara and Nowgong *Indra Sali* has given on the whole satisfactory results, the conditions there apparently being more suitable for this variety.

During the year the following amounts of seed were distributed in 10 lbs. packets amongst the cultivators for trial. Goalpara 20 maunds *Indra Sali* and *George Sali* and 2 maunds *Boro* paddy; Kamrup 40 maunds *Indra Sali*, 6 maunds *George Sali*, 2 maunds *Nagra Sali* and also a small quantity of *Katak-tara As*; Nowgong 15 maunds *Indra Sali*, 6 maunds *George Sali* and one maund *Nagra Sali*; Sibsagar 10 maunds *Indra Sali* and 5 maunds *George Sali*; Dibrugarh one maund of *Indra Sali* and one maund of *George Sali*.

The introduction of higher yielding varieties of rice is probably the most promising line of work in which the Agricultural Department can engage, and it is unfortunate that at present the Assam Valley is dependent on Bengal and the Surma Valley for new varieties. Before we can make much progress in this direction we require at least one, and probably two rice experiment stations for selection work in the Valley, and a number of seed farms where varieties can be tested under local conditions and pure seed multiplied for distribution. In the meantime we should proceed with caution with regard to the Bengal and Surma Valley varieties, introducing them only in such localities where experience has proved conditions to be favourable.

5. As the result of previous demonstrations the demand for sets of superior varieties of sugarcane is now so great that the Department is unable to
Sugarcane varieties.

supply even one-tenth of the demand. Demonstrations therefore would have been superfluous in most districts, and the demonstration staff was employed in distribution work and in endeavouring to arrange for cultivators who are already in possession of the superior varieties to pass them on to their neighbours. Demonstrations however were attempted in a few centres in Nowgong and Goalpara. The Nowgong figures are not yet available, but the cultivators are reported to be more than satisfied as to the superiority of the new varieties, and are extending their cultivation. In Goalpara B147 gave an increase of 2,222 pounds of *gur* per acre, and Tanna 1,566 pounds of *gur* per acre over the local variety *Magh*.

With regard to the distribution of superior varieties, arrangements were made last year to grow setts in 10 centres on cultivators' holdings in Sibsagar district to supply the demand for setts in 1921. The scheme had its disadvantages, but in the absence of departmental Seed Farms it was the best arrangement possible. The demand for setts was enormous and great difficulty was experienced in collection and despatch owing to the distance between the centres, and to the fact that the harvesting of the cultivators' cane extended over a considerable period and setts had to be collected as they became available. Consequently, although a considerable number of setts were eventually supplied, a great many applicants had to be disappointed. The number of setts actually distributed from cane-growing centres in Sibsagar district was over 80,000, of which 10,500 were supplied to the Surma Valley and 5,000 to Tezpur, the remainder going to cultivators in Sibsagar and Lakhimpur districts. In addition 8,000 setts were supplied from the Jorhat Farm, and arrangements were made to purchase over 40,000 setts from Kamrup Sugarcane Farm for distribution in Kamrup, Goalpara, Nowgong and Darrang. Altogether about $1\frac{1}{2}$ lakhs of setts will have been distributed by the end of the season. The number may appear small in comparison with the demand, but with our limited staff it is difficult to cope with the work on a large scale. It should be borne in mind however that there is now a considerable area of improved varieties of sugarcane in Sibsagar and Kamrup, and that this area is being annually extended by the sale of setts amongst the cultivators themselves. In future it would save a lot of disappointment if people requiring large numbers of setts would apply to the local Inspector of Agriculture and ask him to put them in touch with cultivators of our varieties of cane instead of sending in orders for lakhs of setts to be supplied by the Department.

6. As a result of demonstrations with the three roller iron sugarcane mill, these mills are now exceeding-ly popular with the cultivators throughout the Valley, so much so that the demand this year largely exceeded the supply. At present we have to depend on Calcutta for our supply of mills. Owing to the rush of orders from all parts, the Calcutta manufacturers were unable to keep pace with the demand, and consequently consignments arrived late, and towards the end of the season we had to refuse orders for mills. Incidentally the price rose to Rs. 98 by the end of the season as against Rs. 65 pre-war price and Rs. 86 in 1920, but this apparently had no effect in checking the demand. The number of mills actually disposed of through the Seed Depot in the Assam Valley was 262, of which 258 were actually sold to the public and 4 issued for demonstration purposes. The distribution to the various districts was as follows :—

Sugarcane Mills—1920-21.

District.	Number sold.	Number issued for demonstration.	Total.
1	2	3	4
Kamrup	87	...	87
Nowgong	81	1	82
Goalpara	39	2	41
Sibsagar	39	...	39
Lakhimpur	7	1	8
Darrang	5	...	5
Total	258	4	262

The increasing popularity of the mills may be judged from the number sold this year as compared with 141 mills sold last year and only 38 mills the year before. The delivery of the mills and the realization of the price takes up a good deal of the time of our staff in the cold weather months to the detriment of other work, and if the demand for mills continues to increase it will be almost impossible to deal with it. Conse-

quently attempts are being made to induce local firms to take up the manufacture of mills and supply them direct to purchasers. With this object in view three local firms have been supplied with sample mills, and their estimates are now awaited.

Shallow *gur*-boiling pans are not so popular with the cultivators as the three roller mills, but 58 were sold through the Seed Depôt and 6 were used for demonstration purposes during the year. The majority of cultivators prefer a deeper pan holding more juice, but this would defeat the object for which the shallow pan was introduced, *viz.*, more rapid boiling.

7. The improved variety "*Kakaya Bombai*" selected by the Fibre Expert, Bengal, which has shown marked superiority over local varieties in Assam in previous years, was demonstrated in Goalpara, Kamrup and Nowgong. A few demonstrations were also made in Sibsagar but in this district cultivators take little interest in the crop and consequently the results were not promising. In Nowgong "*Kakaya Bombai*" gave an average increase of 409 lbs. fibre per acre over the local varieties, and in Goalpara 166 lbs. per acre. The results of the demonstrations in Kamrup were spoilt by hailstorms and heavy rain.

Arrangements were made by the Seed Depôt for a supply of seed of *Kakaya Bombai* for sale to cultivators, and stocks were sent out to the principal jute-growing districts. The demand however was disappointing. Out of a total of over 50 maunds of seed only some 4 maunds was actually sold, the remainder being widely distributed in small packets by the demonstration staff, chiefly in Goalpara, Kamrup and Nowgong. The distribution carried out in the last two years should have the effect of creating a larger demand for seed next year, and arrangements for a supply of seed have been made accordingly.

8. Demonstrations with superior varieties from Shillong were carried out during the year under report at a number of centres throughout the Valley. The demand for Shillong varieties has increased largely during the last few years, and now the amount of "seed" of these varieties supplied from Shillong through the Seed Depôt is only a fraction of the total amount planted by the cultivators, who are now able to purchase supplies from the local bazars. The seed issued by the Department is more reliable than that obtained locally, hence we can dispose

of as much "seed" as we are able to procure direct from Shillong. The following results were obtained this year:—

Average yield in pounds per acre.

Locality.	Number of centres.	Shillong varieties.	"Deshi" varieties or Bazar seed.	Increase.	Remarks.
1	2	3	4	5	6
Librugarb ...	3	8,925	7,321	1,574	One negative result.
Tezpur ...	2	7,170	6,756	414	
Nowgong ...	7	5,227	4,242	1,005	
Kamrup ...	4	7,992	7,313	678	One negative result.

In Goalpara, with the exception of three centres, the crops both of "deshi" and Shillong varieties were so poor that the results were unreliable. In one of these three centres however where the growth was good the Shillong variety gave an increase of more than 6,000 pounds per acre over the "deshi" variety, while in the other two centres the increases in favour of the Shillong variety were over 3,000 pounds and 350 pounds per acre respectively.

In view of the fact mentioned in last year's report that Darjeeling potatoes had proved superior in yield to Shillong potatoes, in certain centres in Kamrup, arrangements were made this year to give them a further trial. Accordingly trials of Shillong *versus* Darjeeling potatoes were carried out in duplicate in 3 centres in Kamrup and in 2 centres in Sibsagar. In Kamrup the average increase in favour of the Darjeeling variety was 2,013 pounds per acre, but in one centre the Shillong variety gave a better outturn than the Darjeeling. In Sibsagar the increase in favour of the Darjeeling variety was 981 pounds per acre in one centre and 375 pounds in the other, and in one centre where "deshi" seeds were planted on a check plot the increase over "deshi" seed in the case of Darjeeling was 8,290 pounds per acre, and for Shillong 7,309 pounds. The results on the whole are in favour of Darjeeling "seed", but it is difficult to say whether this is due to variety or to Darjeeling being a better locality for growing seed than Shillong. In order to test

this, arrangements have been made to grow "seed" of the Darjeeling variety at Shillong this year for a further trial in the plains against "seed" of the Darjeeling variety from Darjeeling, and also against the "seed" of Shillong varieties from Shillong.

The total amount of potato "seed" issued through the seed depot to the districts was 1,534 maunds, of which 145 maunds were used for demonstration purposes and the remainder sold to the public. Of this over 300 maunds were sold to potato cultivators at Kakilamukh, Sibsagar district, and 230 maunds to cultivators in Nowgong district.

The potato disease (*Phytophthora infestans*) again appeared on the crop at Kakilamukh. Spraying with Burgandy Mixture, which was carried out by the demonstration staff, succeeded in checking the disease and preventing it from spreading.

9. Pulse crops, including Patna *khesari*, *masuri*, *matikalai* and *rahar* were tried in a number of centres. Demonstrations with miscellaneous crops. In Goalpara Patna *khesari* gave an average increase of 136 pounds of grain per acre over the local variety, and Patna *masuri* an average increase of 145 pounds in three centres. In Kamrup 4 maunds of *rahar* seed were distributed, but the crop is reported not to have been very successful. Patna *khesari*, *masuri* and *matikalai* gave good results in this district. In Nowgong $8\frac{3}{4}$ maunds of *rahar* seed was distributed but the crop was attacked by pod borer. In one centre an increase of 166 pounds per acre was recorded. In the same district Patna *khesari* and *matikalai* demonstrated in 9 centres did exceedingly well and were greatly appreciated by the cultivators, the yield of Patna *matikalai* in one centre exceeding that of the local variety by over 800 pounds per acre. In Dibrugarh and Sibsagar small quantities of Patna *khesari* and *masuri* were distributed with indifferent results, except in the case of *masuri* which averaged 1,065 pounds per acre in three centres. *Rahar* was also tried in several centres but the results were not promising.

Fodder crops including *jowar*, cowpea and Guinea grass were demonstrated on a small scale in Goalpara and Kamrup. In Kamrup *jowar* in three centres and cowpea and *jowar* mixed in one centre are reported to have given excellent results. It is difficult however to get cultivators to take any interest at all in fodder crops at present.

Other crops tried successfully in a few centres were barley, linseed, and Pusa wheat No. 12. The latter crop yielded 1,148 pounds per acre in Tezpur and 1,044 pounds per acre in Goalpara.

The question of the improvement of *rabi* crops generally, especially in Goalpara and Kamrup, needs to be taken up seriously, but no progress can be made in this direction until we get an experiment station in one of these districts.

10. Amongst simple methods of improving agriculture in the Assam Valley the conservation of cowdung and village refuse stands out as the most obvious and simple of all. For years now the Department has been preaching this to the cultivators through its Inspectors and Demonstrators with the result that cultivators, especially those who grow sugarcane, have begun to take a little interest in the matter. Endeavours are made to persuade every cultivator with whom we come in contact to erect a cheap shed in which to store cowdung, wood ashes and organic refuse. If the site is well above water-level the cowdung, etc., is stored in a pit, otherwise it is kept above ground within a mud wall. During the year under report the work was continued in all districts, Sibsagar heading the list with a total of 150 sheds and pits constructed during the year.

11. Mr. M. Smith was in charge of the work which consists of the management of the three small experiment stations at Sadiya, Pasighat and Rotang, the distribution of seeds, plants, etc., the demonstration of terrace cultivation, and the improvement of cattle by the maintenance of stud-bulls and castration of inferior local bulls.

At the Sadiya Experiment Station where about 9 acres of land are under cultivation the following crops were grown during the year :—

Sugarcane.—The varieties grown are Striped Mauritius B 376 and B 147 originally obtained from Jorhat Farm. One acre of plant cane yielded 50 maunds 12 seers of *gur*, and one acre of ratoon cane 63 maunds 25 seers of *gur*.

Groundnuts.—Three new varieties were tried, two on $\frac{1}{16}$ acre plots and one on a $\frac{1}{32}$ acre plot, the yields being $21\frac{1}{2}$, $16\frac{3}{4}$ and $11\frac{1}{2}$ maunds per acre, respectively.

Maize.—Abor maize grown on half an acre, yielded at the rate of 17 maunds 12 seers per acre. Ten varieties of Shillong maize were tried on a small scale with promising results except in one case where the crop failed.

Garو cotton.—This was tried on $\frac{1}{2}$ acre. The plants made too much vegetative growth and the yield of seed cotton was only $3\frac{1}{2}$ maunds per acre. The bolls however were much larger than those produced by the variety grown by the Abors.

Aus paddy.—Four varieties were tried of which two failed to produce any ears. Katakara sown on $\frac{1}{2}$ acre yielded at the rate of 18 maunds 33 seers per acre, and C. P. Fine on $\frac{1}{3}$ acre at 19 maunds 11 seers per acre.

Indigo.—Sown on $\frac{1}{2}$ acre made fair growth and was ploughed in for greenmanure.

Potatoes.—"King of Potatoes" from Shillong were planted on $\frac{1}{2}$ acre and yielded at the rate of 81 maunds 12 seers per acre.

Miscellaneous crops.—Pusa wheat No. 4 sown on $\frac{1}{3}$ acre yielded at the rate of $11\frac{1}{2}$ maunds per acre. Coffee plants are making good growth and produced a few berries this year. Papayas on $\frac{1}{3}$ acre produced fruits sold locally for a sum of Rs. 17-14. Cold weather vegetables were grown on an area of about $\frac{2}{3}$ of an acre with the main object of producing seed. A considerable quantity of seed was collected from tomatoes, French beans and peas, but the result was a failure in the case of cauliflowers and cabbages, and not very promising in the case of other vegetables.

Fruit trees.—Guava, lime, lichi, pomelo, peach and orange are thriving. All the guavas and two of the limes fruited this year.

At Pasighat.—One acre under groundnuts yielded 8 maunds 12 seers. Two new varieties were also tried on a small scale, the outturns being 19 maunds and $16\frac{1}{2}$ maunds per acre, respectively. Four acres of terrace cultivation yielded 102 maunds of paddy or at the rate of $25\frac{1}{2}$ maunds per acre.

At Rotung.—The Abors cultivated $12\frac{1}{2}$ acres of terrace rice with exceptionally good results. Orange trees near the fort are flourishing and a few bore fruit. Shillong potatoes were tried during the rains unsuccessfully.

At Remindimbong.—Half an acre of terrace cultivation was undertaken by the Abors for the first time, but the water-supply was irregular and the yield of rice amounted to only 10 maunds per acre.

At Denning.—Terracing was commenced during the year on $1\frac{1}{2}$ acres which gave an outturn at the rate of 25 maunds 5 seers of rice per acre. Groundnuts were tried on $\frac{1}{10}$ acre but the yield was poor. Shillong potatoes tried during the rains were failure.

Distribution of seed, etc.—Sugarcane setts to the amount of 8,150 were given out to 17 cultivators and the crop is reported to have done well. In addition the following were distributed :—Abor maize 2 maunds, Garo cotton 4 seers, "Indra Sali" (rice) 20 seers, vegetable seedlings 10,000, papaya seedlings 800, seed potatoes 17 maunds, groundnuts; and 130 packets of vegetable seeds from the Gauhati Seed Depot were sold.

Improvement of cattle.—Three "stud" bulls are kept at Sadiya and two at Pasighat. Castration of inferior bulls was continued, a total of 229 being castrated during the year under report, 171 at Sadiya, 45 at Pasighat and 13 at Kobo.

12. A Garo Demonstrator is in charge under the supervision of the Agricultural Inspector, Goalpara. This arrangement is not very satisfactory since it is impossible for the Inspector to keep in close touch with the work in the Garo Hills and at the same time to supervise the work in his plain district.

The bulk of the cultivation is on the "jhum" system of mixed cropping, the principal crops being paddy and cotton. The "jhum" are abandoned for from 5 to 10 years, after being cropped for two or three years. During the year under report an attempt was made to introduce greenmanure and bonemeal in third year (abandoned) "jhum" with the object of making it possible to continue the cultivation of paddy in the third year. With regard to results the figures sent in by the Demonstrator cannot be accepted without further enquiry. Potatoes were demonstrated on 17 plots in 8 centres, 25 maunds of "seed" being planted on a total area of $2\frac{1}{2}$ acres. The yield was poor amounting to a total of only 58 maunds 34 seers, or at the rate of about $23\frac{1}{2}$ maunds per acre. In several centres however the crop was badly damaged by porcupines and cattle. Pusa No. 12 wheat was tried in 5 centres, but the cultivators left the crop unprotected and it was grazed by buffaloes.

Groundnuts were grown in 6 centres on a total area of $1\frac{1}{6}$ acre, the total yield being 3 maunds 33 seers, or at the rate of only 6 maunds 15 seers per acre.

In 4 centres 250 setts of sugarcane were distributed for trial, but cattle and whiteants are reported to have destroyed most of the crop.

The Demonstrator while on tour in the district pruned and manured a number of fruit trees, distributed vegetable seeds and

also demonstrated the use of the Meston Plough where conditions were suitable. He also collected over 18 maunds of Garo cotton seeds for supply to the seed depôt and others.

13. Babu Satyendra Chandra Dutta (officiating Superintendent of Agriculture) was in charge till the 19th January 1921, when Mr. L. Barthakur (Superintendent of Agriculture) took over and remained in charge up to the end of the year under report. The clerk M. Mir Afsar Ali left early in February to join the Department of Industries, and Srijut Narayan Chandra Gosswami was appointed in his place. A despatcher was sanctioned at first temporarily and engaged from 1st September 1920. Owing to the large increase in the work of the depôt the post was subsequently made permanent. The seed depôt undertakes the supply of seeds, implements, manures, etc., for sale to the public and also for demonstration purposes. During the year under report the work of the Depôt expanded enormously, and in fact was almost double that of the previous year.

The total quantity of seeds and manures issued during the year was about 84½ tons valued at Rs. 14,486, of which 60 tons valued at Rs. 9,321 were actually sold, the remainder being issued for demonstration purposes and free distribution. The principal item was 1,534 maunds of seed potatoes, of which 1,386 maunds were actually sold to the public. In addition 8,724 packets of vegetable seeds valued at Rs. 1,278 were dealt with and sugarcane setts to the value of Rs. 1,429, the accounts of which went through the depôt.

The value of implements issued amounted to Rs. 25,182, of which Rs. 24,410 were actual receipts by sales, the main item being 267 sugarcane mills actually sold for Rs. 22,510. Four mills were issued for demonstration purposes bringing the total mills disposed of up to 271. The demand for these mills increased enormously during the year, and owing to the difficulty in getting delivery from the Calcutta makers a large number of orders had to be cancelled towards the end of the year. Mr. Barthakur paid two visits to Calcutta in connection with the supply of mills, and it is due to his efforts that we were able to obtain delivery of so many. The price of the mills advanced to Rs. 98 this year as against Rs. 65 pre-war price and Rs. 86 the highest price last year.

Altogether 55 different kinds of seeds, manures, implements, etc., were dealt with during the year. A few of the principal

items not mentioned above are given below :—

—			Quantity sold.	Quantity supplied for demonstration.	Total.
1			2	3	4
			Mds.	Mds.	Mds.
Indra Sali	...	...	6½	134½	141
George Sali	...	...	4	55½	59½
Khesari	...	...	1½	7½	8½
Arhar	...	...	18	91	109
Oats	...	...	11½	9½	21½
Jute seed	...	...	4½	47½	51½
Dhain ka	...	...	110½	½	111½
Bonemeal	...	...	8	35	43
Gur-boiling pan	...	...	58 (number)	6 (number)	64 (number).

The following statement shows the working of the Seed Depot from the financial point of view for the year ending 31st March 1921. Allowing for all charges including depreciation, establishment, rent, etc., a nett profit of Rs. 1,015-14-11 is shown on the year's working. With regard to the amount of Rs. 4,034 under the head "Bills outstanding" the greater portion has been recovered since the close of the year, and only some Rs. 523 remains outstanding and is due to be collected by the Sibsagar Demonstration Staff. The stock in hand at the close of the year was more than double that at the commencement. It consisted chiefly of implements, sugarcane mills, etc., which arrived too late for disposal this season. The usual 10 per cent. depreciation has been deducted, but as this stock is not likely to depreciate in value during storage the figure (Rs. 557-11-0) allowed for depreciation is probably far too high, and thus the figure shown against profit and loss account is too low. In order to be on the safe side however the figure for depreciation has been allowed to stand. If it proves to be too high, next year's account will get the benefit in the profit and loss account.

Statement showing the working of the Gankai Seed Depot for the year ending 31st March 1921.

Assets or Receipts.		Liabilities or charges.	
	Rs. a. p.		Rs. a. p.
Total sale proceeds credited during the year	34,980 14 3	Rent and taxes	...
Bills outstanding	4,034 0 0	Establishment	549 0 0
Stores used in demonstration and free supply	7,417 7 0	Contingencies—other charges	677 8 0
Value of concessions to Honorary Correspondents	152 0 0	Ditto	436 10 9
Deduct—	46,564 5 3	Postage stamps	261 8 0
Outstanding of last year realised during year	732 8 0	Ditto hot and cold weather charges	30 0 0
Sale proceeds of demonstration im- plements	327 6 0	Ditto purchase and repair of furniture	65 12 0
		Total	2,020 6 9
		COST OF PURCHASING STORES.	
		Total expenditure during the year	40,400 14 7
		Less amount unspent—lost by the Agri- cultural Demonstrator, Dhuhri (which will be recouped from him)	100 0 0
		Less amount of bills for previous year	18 1 3
			40,282 13 4
		Depreciation on stock in hand for storing at 10 per cent.	557 11 0
		Freight on stores by credit notes not yet adjusted	53 8 0
		Cost of bills out-standing for purchases during the year	1,704 5 9
		Value of seeds, etc., received free from Farms	1,889 8 0
		Total	47,403 4 10
		Deduct increase in stock—	
		Value of stock in hand on 31st March 1921	5,576 13 6
		Value of stock in hand on 1st April 1920	2,657 1 0
			2,919 13 6
Total Assets	46,504 7 3	Total charges	...
		Profit and loss account	44,488 8 4
			1,016 14 11
		Total	46,504 7 3

Babu Satyendra Chandra Dutta, who as officiating Superintendent of Agriculture, held charge of the Depôt during the greater part of the year, deserves much credit for its successful working. Some of the District Staff were also of great assistance in effecting sales and realising the proceeds. The following deserve special mention:—

Inspectors Srijut Mohi Chandra Gogai and Babu Pulin Behari Ghose, and Demonstrators Chandi Charan Dutta, Sheik Umar Ali, Anandi Ram Gohain, Bhudhar Phukon and Bhojanth Gogoi.

14. There are 20 Honorary Correspondents in the Assam Valley and one in the Garo Hills.

Work of Honorary
Correspondents.

Mr. D. C. Chakravarti, Dewan of the Gauripur Estate, took a great deal of interest in the work of the Department, and has arranged to let us have land on the Estate for demonstration and seed-growing purposes.

Babu Lalit Mohon Dutta of Dhubri distributed a considerable quantity of jute seed. Several sugarcane mills were sold in the neighbourhood of Palasbari through the influence of Srijut Chandra Nath Sarma, Pandit.

Srijut Pratap Narayan Chaudhury of Nalbari grew Shillong potatoes successfully, obtaining an yield of 150 maunds per acre.

In Nowgong district, Babu Jnan Chandra Ray obtained excellent results from 6 bighas of B117 sugarcane and distributed setts to his neighbours; he also reports favourably on *George Sali* paddy. Srijut Boloram Hazarika made successful demonstrations with Shillong potatoes, *Kakaya* *Bombai* jute and *George Sali* paddy, and assisted in the distribution and sale of seeds. Srijut Bhogolatta Hazarika distributed seed potatoes and vegetable seeds and also made demonstrations himself.

At Tezpur Rai Sahib Mohidhar Bhuyan, Mauzadar, grew *Kakaya* *Bombai* jute and *Rahar*, and has since arranged to provide land for growing jute and paddy seed and also sugarcane setts for distribution.

In Sibsaagar, Rai Sahib Narayan Chandra Barua supplied seed of his *George Sali* paddy, and Srijut Debcswar Gosswami of Badlipar again supplied Striped Mauritius sugarcane setts and also made trials of several varieties of *Rahar*.

In Lakhimpur, Srijut Pitambor Saikia, Mauzadar, Khowang, distributed sugarcane setts and *George* and *Indra Sali* paddy seed.

Mr. Barraclough of Lumding experimented with a number of crops but found great difficulty in protecting them against the attacks of wild animals.

A. G. BIRT,
Deputy Director of Agriculture, Assam Valley.

REPORT ON THE AGRICULTURAL DEMONSTRATIONS
IN THE SURMA VALLEY CIRCLE FOR THE YEAR
ENDING 31st MARCH 1921.

1. Maulvi Fazlul Haque Ahmed was in charge of the Demonstrations throughout the year. The staff of Agricultural Inspectors remained the same. Two probationary Agricultural Inspectors joined in the beginning of the year, but remained under training through out. From the beginning of the present year they will be posted to Karimganj and Sunamganj respectively, when each of the five subdivisions of Sylhet will have one Agricultural Inspector. Three Demonstrators were appointed during the year thus bringing their number to 12, in addition to one for North Cachar Hills. They were posted as follows :—

Cachar—Haflong, Silchar and Hailakandi.

Karimganj—Karimganj and Barlekha.

North Sylhet—Sylhet and Fenchuganj.

South Sylhet—Maulvi Bazar, Srimangal and Kulaura.

Habiganj—Habiganj, Shaistaganj and Bejura.

An additional Agricultural Demonstrator was entertained for Tobacco Demonstrations. Two more Demonstrators were appointed on 1st April and posted to Sunamganj (Sylhet) and Katigara (Cachar). Babu Kamini Kumar De, Agricultural Inspector, Habiganj, was on leave for six weeks when the Agricultural Inspector, South Sylhet, remained in charge of his work in addition to his own. The Superintendent of Agriculture was on tour for 185 days during which he inspected the demonstrations and supervised the sale of seeds. He also visited Bomillah twice in connection with the purchase of onion seed and to see the Agricultural Exhibition. As the work of the Seed Depôt is developing it is becoming increasingly necessary for the Superintendent to devote more time to the Seed Depôt

work. The number of days spent on tour by the Agricultural Inspectors were as follows :—

	Number of days on tour.
1	2
Babu Binode Behari Das ...	216
„ Profulla Chandra Dutta ...	304
„ Kamini Kumar De ...	251
„ Romesh Chandra Das ...	185
Maulvi Moshin Ali ...	232
„ Abdul Quadim Choudhury ...	235

The improvement in the work of the Agricultural Inspectors and Agricultural Demonstrators noted in the last year's report continued during the year. As, however, with the rapid expansion of the Department, new appointments are constantly being made, it is necessary to exercise close supervision to see that the activities of the new men are guided along proper channels. As the number of Demonstrators is still very small an attempt was made during the previous year to concentrate their work within fairly small compact areas. During the year under report the scheme was further developed. The demonstrations were concentrated in groups of a few villages in each centre, each Agricultural Demonstrator having 2 or 3 centres to work. Instead of dissipating his energies in travelling over a wide area the Agricultural Demonstrator was required to work intensively in the selected groups. When sufficient progress has been made in these groups work will be taken up in new groups of villages. The result of this system is already noticeable in the rapidly increasing demand for improved seeds in these centres and in the willing co-operation of the cultivators of those localities with officers of our Department.

2. Advantage was taken of the visit of the Director of Agriculture, to Sylhet in August 1920 to call a conference of Officials and non-officials interested in agriculture. The conference was held in the afternoon of the 14th August in the office of the Deputy Director of Agriculture and was presided over by the Deputy Commissioner. It was largely attended by the leading men of Agriculture, to Sylhet in August 1920 to call a conference of Officials and non-officials interested in agriculture. The conference was held in the afternoon of the 14th August in the office of the Deputy Director of Agriculture and was presided over by the Deputy Commissioner. It was largely attended by the leading men of

the town and mofussil. The main object of the conference was to explain to non-officials the work that was being done by the Department and to discuss means as to how the public and the Department could still further co-operate to advance the agricultural interests of the district. A small exhibition of the seeds and manures recommended by the Department, with cultural instructions, was arranged which attracted considerable interest. Charts were hung along the wall showing results obtained by cultivators by the use of improved seeds and manures. The Entomological Assistant showed the common insect-pests and explained the remedies. The Director of Agriculture explained the difficulties encountered in spreading knowledge of improved agriculture among the cultivators and referred to the work already done. There were a number of improvements which could not be carried out on account of the poor condition of the cultivators. He explained that the most hopeful line of work was along the extended use of improved seeds, and invited the public to co-operate with the Department still further. A general discussion followed in which several gentlemen took part. The conference created a good deal of interest among the local public in our work and also afforded an opportunity to our staff to realise the point of view of the public. With a more definite programme an annual conference like this at Sylhet should be very useful in bringing the Department and the public closer together.

A conference of the Agricultural Inspectors of the Surma Valley was also held at the Karimganj Farm on the 11th August where they were shown the experiments going on there and various matters regarding their work were discussed. They also attended the conference at Sylhet.

During the year under report two small agricultural shows were got up at Sylhet and Habiganj in connection with the social service exhibitions held in the two places. Both of them were attended by the Superintendent of Agriculture, and the one at Sylhet by myself. The Agricultural sections drew large crowds and excited a good deal of interest. In 1920, the Agricultural Inspectors and Agricultural Demonstrators of the localities attended the fairs at Katigora (Cachar) and Dhaka-dakshin (North Sylhet) with samples of seeds and manures recommended by the Department and explained their advantages to the cultivators.

Two Agricultural Associations were tentatively started during the year at Bejura (Habiganj) and Sonapur (South Sylhet) with Rai Shahib Joynath Nandy and Maulvi Abdul Wahab, both

Honorary Correspondents of this department—as Presidents of the respective societies. The members were mostly cultivators. The policy of the Department with regard to these has been one of sympathetic guidance rather than that of active interference. Each of the Associations held three sittings, all of which were attended by the Agricultural Inspectors and Agricultural Demonstrators, in charge of the circles and one in each by the Superintendent of Agriculture.

The Director of Land Records and Agriculture and myself attended one of the meetings of the Bejura society. Various topics affecting local agricultural interests were discussed in these meetings and the members appeared to take genuine interest. As the Associations develop they should prove very useful in establishing a link between the Department and the cultivators.

3. The results of the demonstration work can be best judged by the demand for improved seeds and manures. The quantities supplied during the year were over double that supplied during the previous year. *George Sail* and *Indra Sail* proved their superiority almost everywhere except on the comparatively high land of Cachar. *Lati Sail*—a Karimganj Farm selection—has been found suitable and has given increased outturns of 377 to 612 pounds per acre over the local varieties on this type of soil. The *Indra Sail* and *George Sail* have been found to give an average increased outturn of 400 pounds per acre in Sylhet. During 1920, 150 mds. of *Indra Sail* and *George Sail* were sold and distributed, and during the coming year over 500 mds. of the three varieties are being supplied. On a moderate estimate this will sow 1,000 acres, the increased outturn from which may be safely estimated at Rs. 13,000. Our work so long had been confined to the *sail* varieties. During the year under report two *aus* varieties selected at the Karimganj Farm, and *Kataktara* selected at the Dacca Farm were tried in a few places with success. The *Murali* gave an average increase of 450 pounds per acre. All these varieties are being tried on a large scale during the present season. With the selected *Murali* and *Kataktara* for *aus* land, *Indra Sail*, *Lati Sail* and *George Sail* for different types of “*Sail*” land, we shall now be in a position to supply improved paddy seeds for different types of *aus* and *sail* land in the Surma Valley. Out of the 1,963,000 acres of *aman* paddy in the Surma Valley about one-third is fit for *sail* paddy. Even if half of this area is transplanted with the improved seed the wealth of the Valley can be increased annually by Rs. 40,00,000 by the use of improved varieties of *sail* paddy alone. This should not be at

It is very difficult in a few years' time. Enquiries indicate that a considerable portion of the produce of 150 maunds of *Indra Sail* and *George Sail* distributed in 1920 are being kept for seed, and about 3,000 acres should be under the improved rice next season, which should yield a net profit of Rs. 40,000 next year. One hundred forty maunds of *Kakaya* Bombay jute seed have been obtained for sale and distribution during the present year. On account of the low prices of jute during the last few years, the cultivation of jute has become very much restricted during the present season and it is doubtful whether all this seed will be sown. This variety gives an increased outturn of 5 maunds per acre over the local varieties. The demand for Shillong potatoes is steadily increasing. One thousand two hundred forty-seven maunds have been supplied to cultivators in the Surma Valley against 376 maunds of previous year. In many places the cultivation of potatoes is entirely new and is proving an additional source of income to the ryots. There was again a keen demand for cuttings of improved varieties of sugarcane and for three roller iron mills and shallow pans. It was possible, however, to supply only 20,000 cuttings. In future, sugarcane cuttings will be distributed only on the understanding that one and a half times the number of cuttings distributed will be returned. Sixty-six mills and 16 pans were sold as against 11 and 6 respectively of the last year. It was difficult to get mills at reasonable prices—the price having risen to over Rs. 90 per mill.

4. The demonstrations carried out during the year consisted of the following :—

Demonstrations during the year.

- (1) Manurial tests on paddy.
- (2) Introduction of superior varieties of paddy.
- (3) Jute demonstrations.
- (4) Introduction of superior varieties of sugarcane.
- (5) Introduction of Shillong potatoes.
- (6) Introduction of pulses and oil seeds.
- (7) Water Hyacinth Ash manurial tests on jute, *mukhi* (*kachu*), and potatoes.
- (8) Trial of new crops.
- (9) Introduction of three roller iron mills and shallow pans.
- (10) Miscellaneous.

5. The manurial demonstrations on paddy consisted of the following :—

Manurial demonstrations on paddy.

- (a) Bonemeal.
- (b) Bonemeal and *Dhaincha* on *sail* paddy.

(c) *Dhaincha* alone for *sail* paddy.

(d) Bonemeal and oilcake.

Bonemeal was applied at the rate of 217 pounds (3 maunds) and oilcake at the rate of 494 pounds (6 maunds) per acre. *Dhaincha* was sown at the rate of 30 pounds per acre and ploughed in about 2 weeks before transplanting. Unfortunately on account of the early rains *Dhaincha* did not grow at all and very few results could be recorded. An effort is being made to sow *Dhaincha* earlier during the present season. The results of the various manures in the different localities are shown in the following table :—

Applied in 1920.

Kind of treatment.	Number of demonstrations.	Increase in pound per acre.			Profit or loss.	Remarks.
		Average increase in output.	Value of increased crop at Rs. 2 12 per maund.	Cost of manuring.		
1	2	3	4	5	6	7
Bonemeal	2	343	Rs. s. p. 11 8 3	Rs. s. p. 15 0 0	Rs. s. p. 3 7 9	Loss—North Spibet.
Bonemeal	4	570	19 9 0	15 0 0	3 8 0	Profit
Bonemeal and oilcake .	4	576	19 5 0	22 8 0	3 3 0	Loss } Karimganj.
Bonemeal	5	317	10 11 0	15 0 0	4 5 0	Loss
Bonemeal and oilcake ...	4	512	17 3 0	22 8 0	5 5 0	" } South Spibet.
Bonemeal and Dhaincha	1	250	9 6 3	16 12 0	8 5 0	" }
Bonemeal	2	513	17 6 3	15 0 0	2 6 3	Profit
Bonemeal and oilcake ...	2	101	3 6 6	22 8 0	19 1 0	Loss } Habiganj.
Bonemeal	2	309	12 6 0	15 0 0	2 17 0	Loss
Bonemeal and Dhaincha	3	24	0 15 6	16 19 0	15 12 6	" } Cachar.
Bonemeal and oilcake ...	1	400	13 7 0	30 0 0	16 8 6	" }
Dhaincha	1	164	5 9 0	1 13 0	3 12 0	" }

Price of bonemeal is charged at Rs. 5 per maund.

RESULTS IN 1919 AND 1918.

The plots manured in 1919 and 1918 were kept under observation for the 2nd and 3rd year. Their results are shown below :—

Applied in 1919.

Kind of treatment.	Number of demonstrations.	Average increase in pounds per acre.			Value of increased crop at Rs. 2-12 per maund.	Cost of manuring.	Profit or loss.	Remarks.
		1920.	1919.	Total increase.				
1	2	3	4	5	6	7	8	9
Bonemeal and Dhaincha.	1	848	109	1,017	Rs. a. p. 31 2 3	Rs. n. p. 16 12 0	Rs. n. p. 17 6 3	Profit.
Limestone and Dhaincha.	1	90	10	100	3 6 0	11 12 0	8 6 0	Loss
Bonemeal ...	1	488	4'2	890	29 14 6	15 0 0	14 14 6	Profit
Bonemeal and Dhaincha.	1	440	433	873	29 5 3	16 12 0	12 9 0	„
Bonemeal ...	1	428	-261	177	5 15 3	15 0 0	9 0 9	Loss
Bonemeal and Dhaincha.	1	479	1,154	2,023	68 3 9	16 12 0	51 7 9	Profit
Bonemeal and Oilcake.	1	280	350	770	23 13 6	22 5 0	2 5 6	„
Bonemeal ...	1	307	351	658	23 1 0	15 0 0	7 1 0	Profit
Bonemeal and Dhaincha.	1	132	214	346	11 10 0	16 12 0	5 2 0	Loss
Bonemeal and Oilcake.	1	166	184	350	11 12 0	22 8 0	10 12 0	„
Bonemeal ...	2	142	382	524	17 9 6	15 0 0	2 9 0	Profit
Bonemeal and Dhaincha.	2	790	389	1,169	30 3 6	16 12 0	22 7 6	„
Limestone and Dhaincha.	2	NH	60	60	2 1 0	11 12 0	9 11 0	Loss

Applied in 1918.

Kind of treatment.	Number of demonstrations.	Average increase in pounds per acre.		Total increase of crop.	Value of increased crop.	Cost of manuring.	Profit or loss.	Remarks.
		1920.	1918 and 1919.					
1	2	3	4	5	6	7	8	9
Bonemeal ...	2	120	307	427	Rs. a. p. 14 5 3	Rs. a. p. 15 0 0	Rs. a. p. 0 10 9	Loss—North Sylhet.
Bonemeal ...	2	—239	552	313	10 8 9	15 0 0	4 7 3	Loss—Karimganj.
Bonemeal and oilcake.	1	413	308	721	24 3 9	23 8 0	1 11 9	Profit
Limestone and Dhaincha.	1	141	315	456	15 5 3	11 13 0	3 9 3	„ } South Sylhet.

The results generally confirm the last year's conclusions. When really poor soils are chosen bonemeal is found profitable in the second year and in some cases even in the 1st year. Combined with an organic manure such as *Dhaincha* or oilcake bonemeal is usually profitable. *Dhaincha* is always profitable but the difficulty is to ensure a stand for which very early sowing is necessary.

6. With a view to introducing superior varieties of paddy Indra *Sail* and George *Sail* were tested against the local varieties in all the Demonstration Centres, and showed their superiority everywhere except in Cachar. It was found during the last two years that neither Indra *Sail* nor George *Sail* did very well on comparatively high land—particularly in Cachar. As a result of the work at the Karimganj Farm during the last few years it is now possible to recommend another improved variety—Lati *Sail*—for this type of land. It was tried last year in a few places in Karimganj, North Sylhet and Cachar and it invariably gave much higher yield than the local varieties where ever tried. It is important to note however that the experience gained so far indicates that Lati *Sail* should be grown only on comparatively high land. It is hoped that rapid progress will

now be made in the demonstration work in the district of Cachar. During the year under report three *aus* varieties, *murali* ³⁶/₃₀, *Dumai* ¹³⁸/₆ (a quick growing variety), and *Kataktara* were tested in a few places and proved superior to the local varieties in every place. The first two are Karimganj Farm selections and the third a Dacca selection by the Economic Botanist to the Government of Bengal. The Lati Sail and the *aus* varieties will be distributed on a large scale next year. The results of the demonstrations are given below :—

Superior varieties.	Number of demonstrations.	Average outturn per acre.	Average outturn of local paddy per acre.	Average increase per acre.	Profit—paddy at Rs. 2.12.	Remarks.
1	2	3	4	5	6	7
					Rs. a. p.	
Indra sail ...	9	2,152	1,800	352	11 13 3	North Sylhet.
George sail ...	4	2,370	2,153	217	7 4 9	
Lati sail ...	2	2,453	2,081	377	12 11 0	
Kataktara ...	1	3,136	1,936	1,200	40 4 6	
Indra sail ...	5	3,509	3,078	431	14 7 0	Karimganj.
George sail ...	5	2,506	2,100	406	16 10 3	
Lati sail ...	2	2,057	1,508	549	18 7 3	
Standard <i>murali</i> ...	4	1,609	1,159	450	15 2 0	
Standard <i>dumai</i> ...	1	945	808	140	4 12 0	
Indra sail ...	4	2,311	1,921	390	13 2 0	South Sylhet
George sail ...	4	2,206	1,921	282	9 7 9	
Indra sail ...	4	2,406	1,861	547	18 6 3	Habiganj.
George sail ...	4	2,504	1,861	643	21 10 0	
Indra sail ...	7	2,032	2,030	2	0 1 0	Cachar.
George sail ...	4	2,060	2,030	30	1 0 6	
Lati sail ...	4	2,642	2,030	612	20 9 0	

7. These consist of :—(a) Introduction of superior variety, e.g.,
 Jute. Kakaya Bombai. (b) Manurial demonstra-
 tions.

(a) The superiority of Kakaya Bombai variety has been definitely established in the Habiganj subdivision—the only jute-growing area in this Valley. The work now really consists of attempts at introducing Kakaya Bombai Jute in altogether new localities. The season was unfortunately unfavourable for jute throughout the Valley, and the few results which it has been possible to record are not reliable.

(b) Bonemeal and Water Hyacinth Ash were tried on jute with satisfactory results. Bonemeal plots gave an average increase of 76 lbs. per acre. The results with Water Hyacinth Ash on jute, *mukhi kachu* and potatoes are given in paragraph 11.

8. The year was very favourable for the sugarcane crop. But unfortunately the improved varieties were much damaged by jackals and stolen by thieves. It was therefore possible to obtain figures of comparative tests only from a very few places. The results are given below :—

Average yield of <i>gur</i> per acre in pounds.			
		In Cachar. lbs.	In Sylhet. lbs.
Striped Mauritius	...	3,898	2,225
Local Kejoo	...	1,432	...
Khagri	...	2,718	...
Dhal	...	1,854	1,854

It was very difficult to obtain enough cuttings for supplying the demand. Most people kept all the cuttings they could spare for their own use and sold the balance to their neighbours. Altogether 20,700 cuttings have been distributed during the year.

The demand for sugarcane mills is also increasing, 66 having been sold during the year.

9. The potato demonstrations consisted of the trial of the Shillong potatoes against local varieties and of a comparison of medium size (recommended by the Department) against the very small size in general use in the plains. As there is already a very great demand for the Shillong varieties—the demand outrunning the supply—the varietal demonstrations were organised only in places where the cultivation of potatoes was more or less new. The potato crop

last year was badly damaged by cut worms and the outturns were rather poor. The results are shown below :—

Place.	Number of demonstrations.	Yield of potatoes in pounds per acre.				Remarks.
		Superior variety.	Bhela-ganj.	Local.	Average increase per acre.	
1	2	3	4	5	6	7
North Sylhet	...	6	7,114	6,350	...	Lbs. 764
South Sylhet	...	4	4,295	...	4,095	200
		2	7,622	5,766	...	1,856
Karimganj	...	5	4,793	3,641	...	1,152
Habiganj	...	2	7,176	5,918	...	1,258
Average	...	19	6,200	5,419	4,005	1,046
			5,154			
Cachar	...	7	3,236	...	1,744	1,492

Place.	Yield in pound per acre.		
	Big size.	Small size.	Average increase per acre.
1	2	3	4
North Sylhet	...	4,944	4,424
Karimganj	...	5,338	3,439
South Sylhet	...	15,189	15,189
Habiganj	...	9,900	9,319
Average	...	8,845	8,093

10. *Khesari*, *Masuri*, peas and gram were tried on all the centres. But as in the previous year the pulses and oil seeds. results were not very satisfactory. Late rains interfered with timely sowing and insects caused considerable damage during the ripening period. It is very doubtful whether pulses will prove a profitable crop in this Valley except in a few

special localities. *Arahar* was distributed in small packets. The outturn of the pulses are given below :—

Place.	Outturn in pounds per acre.				Remarks.
	Khesari.	Matari.	Pesa.	Gram.	
1	2	3	4	5	6
North Sylhet ...	975	645	473	730	
Karimganj ...	486	383	490	543	
South Sylhet ...	...	138	290	...	
Habiganj ...	...	...	...	...
Average ...	731	389	418	637	
Cachar ...	189	...	831	...	

11. The experiments made for combating the Water Hyacinth pest has been described in great detail in the last year's report. The only economical step which can be recommended so far for general use is the application of Water Hyacinth Ash as manure on jute, *mukhi*, and potato. With a view to demonstrating the use of the ash tests were carried out in various centres and the results are given below. The ash was applied at six maunds per acre. The demonstrations are being extended during the coming year and 26½ maunds of ash have been prepared.

Place.	Number of demonstrations.	Yield per acre in pounds.			Remarks.
		Manured with W. H. Ash.	No manure.	Increase.	
1	2	3	4	5	6

JUTE.

Habiganj ...	3	963	717	246
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MUKHI (KACHU).

North Sylhet ...	2	9,152	6,440	2,712
South Sylhet ...	2	16,353	13,417	2,933
Habiganj ...	2	5,727	4,258	1,469
Average	10,410	8,038	2,372

POTATOES.

Habiganj ...	3	10,990	10,276	614
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12. The efforts in growing fodder crops have not met with much success. Groundnuts were tried successfully in various places, particularly in Karimganj, and yielded from 1,124 to 2,500 pounds per acre. It is particularly suitable for light sandy soils which would not grow other crops profitably.

13. These are now coming into general use and are being highly appreciated. Their use is being very much restricted on account of their increasing cost, the prices having gone over Rs. 90 per mill. Sixty-six mills and 16 pans were sold during the year.

14. People are also being taught the economical benefit of conserving cowdung in covered pits and the Agricultural Demonstrators have been instructed to pay more attention to this work.

ANNUAL REPORT OF THE SYLHET SEED DEPOT FOR THE YEAR ENDING THE 31ST MARCH 1921.

15. Maulvi Fazlal Haque Ahmed was in-charge of the work of the seed depot throughout the year, and was assisted by a clerk. A despatcher has been appointed since 1st March 1921. The services of the former clerk had to be dispensed with for unsatisfactory work.

The year has seen considerable expansion in the work of the seed depot. The value of stock disposed of in the year was Rs. 31,927-1-8, and the stock in hand is worth Rs. 9,566-12-9. The following quantities of seeds and manures were supplied during the year :—

			<i>Seeds.</i>		
			Mds. srs. ch.	Pounds:	
Cowpea	...	...	1 0 0	82	
Cotton	...	...	0 4 6	9	
Country vegetables	...	...	65 packets	...	
Dhaincha	...	...	17 11 0	1,416	
English vegetables	...	...	2,032 packets	...	
Groundnut	...	...	6 3 8	499	
Jute	...	...	2 39 12	246	
Jowar	...	...	1 34 0	151	
Linseed	...	...	53 15 12	4,378	(1·96 tons).
Mustard	...	...	1 34 8	152	
Maize	...	...	3 0 0	246	
Oats	...	...	2 0 0	164	
Onions	...	...	125 28 8	10,398	(4·60 tons).
Potatoes	...	...	1,439 7 8	108,018	(52·81 ").
Pulses	...	...	234 20 8	19,230	(8·60 ").
Paddy	...	...	237 36 0	19,507	(8·73 ").
Sunhemp	...	...	2 6 0	176	
Tobacco seed	...	...	0 0 4	1	
Wheat	...	...	5 20 0	451	

Plants.

Plantains	...	...	...	80 nos.
Pineapples	...	...	...	1,154 "
Sugarcane setts	...	...	...	20,700 "

Manures.

		Mds.	srs.	ch.	Pounds.
Bonemeal	...	1,809	4	4	(48 04 tons).
Limestone	...	4	30	0	389
Water Hyacinth Ash	...	100	0	0	(3'67 ").

Implements.

Iron pans	...	...	...	16 nos.
Meston ploughs	...	...	...	5 "
Pl. Jr. Handhoes	...	...	...	4 "
Rakes	...	...	...	3 "
Sugarcane mills	...	...	...	68 "

The demand for Shillong seed potatoes was very heavy evidently due to the satisfactory results obtained last year. In Bejura a large number of cultivators had to be disappointed. Shillong potatoes were tried with success in many new centres. One thousand four hundred thirty-nine maunds were supplied during the year as against 461 maunds last year. They were distributed as follows:—1,139 maunds sold to the local cultivators, 25 maunds supplied to Honorary correspondents, 134 maunds supplied outside the province and 83 maunds used for demonstration. Fifty-eight maunds represent the loss in transit and storing.

The demand for three roller iron sugarcane mills is also increasing rapidly. Sixty-six mills were supplied during the year as against 11 last year. Great difficulty was experienced in getting mills as prices rose very rapidly. With the exception of one firm at Calcutta mills could not be purchased from anywhere at all. If enough mills were available a much large number could have been sold.

A new item taken up by the seed depôt was the supply of onion seed near Itakhola in the Habiganj subdivision. Owing to the early spring rains in 1920, the onion crop of the villages near Itakhola suffered considerable damage. The crop was very short and useless for seed and without a timely supply of seed there was little prospect of any crop at all. As people usually kept their own seed there was no local trade in this line. We received an application for the supply of 1,000 maunds of seed. After enquiry it was found that Comillah was the only place from where suitable onion seeds could be obtained. After a few consignments of seed were purchased prices rose very quickly and encouraged by our example a

local merchant also brought some seed. Altogether 181 maunds of seeds were sold. On account of rains late in October the season for sowing was retarded and there was considerable wastage in storing. Although a loss of Rs. 382 was incurred in this particular transaction, about 30 acres were sown with the seed we supplied. During harvest season onions sold at a very high rate and the value of the crop obtained from the seed supplied by us was about Rs. 25,000; but for the timely help given by the Department hardly any crop would have been obtained.

During the period of high prices last year there was a general desire to grow more pulse seeds in this Valley. For high land 100 maunds of *Arahar* seed was purchased. As the prices of pulses went down there was little demand for *Arahar* seed at the sowing time and the bulk of this consignment had to be sold at a loss of Rs. 427.

The idea of having rural seed depôts—described in the last year's report—was developed during the year. Temporary sheds were hired during the winter at Nayapara (near Bejura), Kulaura, Matiganj (near Srimangal). An apprentice was put in charge of each of these godowns. Seeds were also stocked at Bejura itself and Manik-kona and Shaistaganj. In all these places seeds (mostly potatoes and pulses) were sold in cash. The work was supervised by the Agricultural Inspectors but the accounts were all amalgamated with the accounts of the main seed depôt at Sylhet. The depôts were frequently inspected by the Superintendent of Agriculture as well as by myself during the working season. These were well appreciated by the cultivators, as they could see the seeds they were purchasing. They were very useful in avoiding the rottag at Sylhet as many of the seeds—specially potatoes—were sent direct to these stores instead of through Sylhet. The most successful was the store in Bejura centre from where seeds to the value of Rs. 4,772-8-0 was sold.

The accompanying balance sheet shows a loss of Rs. 636-15-11 only. This is due almost entirely to the loss incurred by the transaction in onions and *Arahar* seed, but for which there would be a small profit. The outstanding dues are very heavy. This is due largely to the fact that in a few new centres potatoes were sold on the understanding that the price would be paid on the formation of Co-operative Credit Societies but the amounts had not yet been realised at the end of the year. The amounts are expected to be soon realised. Out of the stock of Rs. 9,566-12-9 stores worth Rs. 1,886-0-0 has been sold since the close of the year.

Statement showing the working of the seed depôt, Sylhet, for the year ending 31st March 1921.

Assets or receipts.			Liabilities or charges.		
	Rs.	a. p.		Rs.	a. p.
Total amount of sale proceeds ...	25,784	7 0	Rent ...	500	0 0
<i>Deduct</i> outstanding of last year ...	323	14 0	Establishment ...	513	0 6
			Contingencies including freights and packing charges ...	1,385	4 3
Receipts of current year ...	25,460	9 0	<i>Add</i> credit note charges not yet debited	177	1 0
Bills outstanding ...	2,063	8 2	Purchase of stores ...	31,373	9 7
Value of stores supplied to Honorary Correspondents at concession rates	201	4 6	Cost of stores received free from Farm, etc. ...	786	10 0
Value of stores supplied to the Farms and Gauhati Seed Depôt and Demonstrations ...	3,393	1 0	Depreciation in value of stock in hand at 10 per cent. of cost price	958	0 0
Total ...	32,017	6 8	Total ...	35,491	9 4
<i>Deduct</i> amount of advances received ...	90	5 0	<i>Add</i> price of Boro-meal advanced last year ...	2,818	0 0
Total sale proceeds	31,927	1 8	Cost price of stock in hand on 1st April 1920 ...	3,821	5 0
			Cost price of stock in hand on 31st March 1921 including Rs. 223-6-3 for furniture	9,566	12 9
			Increase in stock ...	5,745	7 9
			Loss ...	636	15 11
			Total expenditure ...	31,927	1 8

DEMONSTRATION IN KHASI AND JAINTIA HILLS.

16. Mr. L. L. Reade was in charge of the work throughout the year. He was also in charge of the duties of the Fruit-Inspector. A young Khasi has been sent to Sabour for training with a view to being ultimately

Staff.

appointed as Fruit-Inspector. The Agricultural Inspector was assisted by four Agricultural Demonstrators stationed at Shillong, Mawphlang, Jowai and Umran, respectively.

One of the Demonstrators was on medical leave for 8 months and little progress was made in the work in Bhoi circle. The Agricultural Inspector was on tour for 225 days during which he frequently visited all the demonstration centres in the Khasi Hills. He also attended the Auxiliary Force camp held in March 1921 in Tezpur.

Apart from organising and supervising the bonemeal and potato demonstrations, his main work consisted of arranging for the supply of seed potatoes for the plains and of bonemeal for Jowai. The demand for seed potatoes is increasing very rapidly and it may be necessary to depute one additional Agricultural Inspector during the next season for assisting in the work.

17. The demonstrations consisted of the following items:—

- (1) Manurial demonstrations with bonemeal on paddy.
- (2) Introduction of superior varieties of potatoes.
- (3) Trial of new varieties of paddy and miscellaneous crops.

18. The majority of the paddy cultivators in Shillong, Jowai and Mawphlang have now realised the value of bonemeal as manure for wet land paddy.

Manurial demonstrations.

Fresh demonstrations are only being carried out in new localities where its value has not yet been proved by actual experiments. There were seven plots of about $\frac{1}{4}$ acre each, the bonemeal being applied at the rate of 217 pounds per acre. The results were as follows:—

No.	Locality.	Cultivators.	Yield of grains in pounds per acre.		Increase in pounds, per acre.
			Treated.	Untreated.	
1	2	3	4	5	6
1	Wahryngup ...	Kpakaka ...	1,053	702	351
2	Umsawmat ...	Debi ...	1,249	1,077	172
3	Nangthhed ...	Guder ...	1,469	1,205	264
4	Ummawlong ...	Wet ...	1,542	1,056	486
5	Pamra ...	Dou ...	1,493	913	580
6	Khwan ...	Kaka Bet ...	1,703	1,293	405
7	Mawung ...	Tishon ...	1,897	1,316	581
		Average ...	1,486.56	1,072.42	414.15

The plots originally manured in 1919 were kept under observation without any further manuring and the results of the 2nd year are as follows :—

No.	Locality.	Cultivator.	Yield of grains in pounds, per acre.		Increase in pounds, per acre.	Increase in two years in pounds.
			Treated.	Untreated.		
1	2	3	4	5	6	7
1	Myllem ...	Wellington ...	1,251	1,128	124	450
2	Lynjkien ...	Ka Liti ...	1,160	927	233	455
3	Kynshi ...	Junom ...	1,332	1,049	283	814
4	Borjai ...	Pring ...	1,401	1,066	335	810
5	Pynurkba ...	Synsha ...	1,575	1,105	470	962
6	Nongpol ...	Basir Ahmed	1,673	1,362	311	736
		Average ...	1,413.5	1,106.1	507.4	711.8

THIRD YEAR'S DEMONSTRATIONS.

The plots originally manured in 1918 were also kept under observation, the results being as follows :—

No.	Locality.	Cultivator.	Yields of grains in pounds, per acre.		Increase in pounds, per acre.	Increase in 3 years.
			Treated.	Untreated.		
1	2	3	4	5	6	7
1	Sohanrich ...	Rangmusak ...	1,189	831	358	1,718
2	Jarsin ...	Ketting ...	624	593	31	350
3	Mawshut ...	Ka Kyriup ...	1,176	1,052	124	47
4	Barapani ...	D. Ropmay ...	1,325	1,104	221	1,230
		Average ...	1,078.5	895.0	183.5	967.8

During the year fresh demonstrations with bonemeal on upland paddy were carried out in four centres only.

The selected plots were about $\frac{1}{4}$ acre each and were manured with bonemeal at the rate of 247 pounds per acre before sowing. The results were as follows :—

No.	Locality.	Cultivator.	Yields of grains in pounds, per acre.		Increase in pounds, per acre.	Remarks.
			Treated.	Untreated.		
1	2	3	4	5	6	7
1	Sohryngkham...	Nahon ...	...	...	...
2	Mowvariah ...	Krep ...	530	473	57	
3	Migmyntdu ...	Ring ...	821	747	74	
4	Syat ...	Moser ...	942	790	246	
		Average ...	764.33	672.0	92.33	

These demonstrations have been omitted from the next year's programme. No result could be obtained from any plots originally manured in 1919 as paddy was not grown in any one of them. The practice adopted by the upland paddy cultivators in the Hill Districts is that they sow paddy on uplands (generally of the previous year *jhum*) and after one crop they leave it fallow as the land is generally too exhausted.

During the last summer 450 maunds of bonemeal were sent to Jaintiapur and 568 maunds to Shillong, 1,031 maunds were sold in Shillong and Jowai during the year. Another 425 maunds received too late for the last paddy crop was sent to Jowai in September, which is being sold now. As stated in the last year's reports the price of bonemeal has become almost prohibitive. The bone-grinding mill of Upper Shillong Farm was sold to Messrs. Kilburn & Co. on condition that they would install the plant at Sylhet and supply the requirements of the Department at Calcutta price, thus saving the steamer freight. Five hundred maunds have been obtained from them during the year under report, of which 389 maunds have been sent to the Khasi Hills. This as well as the quantity left over from last year's stock is being sold now, and the whole of this is expected to be disposed of during the coming year.

19. Demonstrations with improved potatoes were conducted during last summer in 9 centres with the following results:—

No.	Locality.	Cultivators.	Yield in lbs. per every manna supplied.	Remarks.
1	2	3	4	5
1	Mawstem ...	Loag ...	379	
2	Ditto ...	Ring ...	294	
3	Mawphlang ...	Semeon ...	338	
4	Ditto ...	Simon ...	401	
5	Polengshyrkap ...	Mani ...	259	
6	Jowai ...	General ...	379	
7	Mawkyndang ...	Catholic Mission ...	675	
8	Pamdolui ...	Saler ...	488	
9	Rangsohltam ...	Sohen ...	487	
		Average ...	408.66	

The yield of potato crop was exceptionally bad mainly owing to the potato disease described later, which caused considerable damage throughout the Khasi Hills.

The improved farm varieties have become very popular in all places where they have been tried and are gradually replacing the local varieties in the Khasi Hills.

The Darjeeling potatoes (a slightly reddish, sticky variety) are said to be more prolific than the mealy white varieties grown in the Khasi Hills. A small quantity was obtained and tried in different places in Shillong, Jowai and Mawphlang. The tubers failed to sprout in time with the result that a few very small tubers only were obtained. They will be tried again.

In 1919 there was heavy rotting in the Khasi Hills potatoes. This was thought to be due to unfavourable weather. During the last year the rotting became even more serious. Enquiry led to the discovery that the rotting was due to some specific diseases of which the "sprain" was the most common. The Imperial Bacteriologist of the Pusa Research Institute visited Shillong in September 1920 and examined the potatoes both in the field and in the

godown. Samples were also examined in the Pusa Laboratory. Investigations are being carried on to discover which of the organisms are mainly responsible for the damage, and to find out remedial measures. There was a suspicion that the organisms causing the rotting would be carried through seeds. With the object of renewing the seeds a lot of 4,600 pounds of fresh seeds has been obtained from Scotland from Messrs. Suttons & Sons. The seeds were kindly arranged by Mr. A. G. Birt, Deputy Director of Agriculture, who was then on leave in England. These have been planted in the Upper Shillong Farm and the seeds will be distributed next year.

A pamphlet in Khasi has also been issued amongst the cultivators describing the common signs of the disease and advising them to use fresh land and disease-free seeds and to spray their plots, as general preventives.

Demonstrations in spraying with Bordeaux mixture against potato blights (*Phytophthora Infestans*) were carried out in two centres in Mawphlang with satisfactory results.

20. As the demand from the plains for improved varieties is rapidly increasing it has become necessary to look beyond the Upper Shillong Farm for the seed supply. To ensure an adequate supply as well as to preserve the purity of the seeds the following practice is being followed since 1918. Pure seeds from the Farm are supplied to the cultivators who undertake to grow them in separate plots and return one and a half times the seeds advanced. They also undertake to sell the whole of the produce to the Department at local rates but only those suitable for seed purposes are taken. As the seeds must be kept pure and only those of selected size are taken, a premium of annas 2 to annas 4 per maund over the bazar rates are given. In 1919, 150 maunds were issued under this system. In 1920, 156 maunds, and during the present year 250 maunds were issued. Unless fresh seeds grown under our own supervision are supplied every year there is a great danger of the seeds deteriorating and being mixed up. As the demand is rising rapidly it will be impossible in a year or two to produce at the Upper Shillong Farm even the quantity required for distribution among the cultivators. It will soon be necessary to arrange with private cultivators near Shillong to act as our seed-growers.

During the year under report 121·63 tons (3,370 maunds) of seed potatoes were supplied as against 72·5 tons in 1919 and 43 tons in 1918. These were distributed as follows :—

	Tons.	Maunds.
Assam Valley <i>via</i> Gauhati ...	56·32	1,601·25
Surma Valley <i>via</i> Gauhati ...	21·1	575
Surma Valley <i>via</i> Thariaghat ...	32	864
Issued on the return system ...	10·83	292·5
Issued for demonstration ...	·33	9
Cultivator in Khasi and Jantia Hills	1·05	28·25
<hr/>		<hr/>
Total ...	121·63	3,370·5
<hr/>		<hr/>

21. Attempts were made to grow Naga and Bhutia Hill
rices in a few places but proved failure. The
Trial of new varieties of paddy and miscellaneous. Mawsiah Khaum (a Khasi Hill variety) however proved superior to other local varieties in a few places.

Ploughing demonstrations with Weston plough were tried with success on wet land paddy plots at Kyrchem, Umsing and Nongpoh. The use of Turnwrest plough was demonstrated at Iapnagar.

22. During the year considerable damage was caused to
paddy by insect-pest in Jowai, Umran and
Insect-pest. Mawphlang. Ker sine emulsion was tried in a few places and proved effectual. The Entomological Assistant toured extensively in the Khasi Hills in June and July and collected several specimens of these pests with a view to studying their life history.

The cultivators' orchards started last year are making good
progress. Three new orchards were started
Demonstrations in fruit growing. at Raliang, Jowai and Mawnai. Cultivators were given instructions regarding the care of fruit trees generally and a large number of grafts were made by the Agricultural Demonstrators with the object of teaching the cultivators.

Spraying demonstrations. Spraying demonstrations were carried out at Upper Shillong and Umlyngka.

23. The following seeds and plants were supplied during the year :—

Supply of seeds and plants.

Orange seedlings	...	...	1,180 nos.
Lime (Soh Myndong)	...	...	407 "
Lime (Soh kwit)	...	...	50 "
Lime (Soh Sying)	...	...	31 "
Lemon cuttings	...	...	51 "
Improved orange seedlings	...	...	91 "
Plum cuttings	...	...	68 "
Plum seedlings	...	...	25 "
Peach seedlings	...	...	67 "
Pear grafts	...	...	10 "
Spanish chestnut	...	...	5 "
Sugarcane cuttings	...	...	150 "
Maize seeds	...	...	209 lbs.
Coffee seeds	...	...	45 "
Upland paddy	...	...	82 "
Castor seeds	...	...	2 "
Orange seeds	...	...	3 "
Ornamental plants	...	...	136 plants.
Eucalyptus	...	...	10 "
Vegetable seeds	...	...	233 packets.

DATED SYLHET :

The 15th April 1921.

} J. N. CHAKRABARTY,
Deputy Director of Agriculture,
Surma Valley and Hill Districts.